



FortiOS™ Handbook - Virtual Domains

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11 February, 2016

FortiOS™ Handbook - Virtual Domains

01-526-188666-20160211

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Change Log

Date	Change Description
11 February, 2016	Changed statements about the number of VDOMs that different FortiGate models support to the following: "By default, most FortiGate units support 10 VDOMs. Many FortiGate models support purchasing a license key to increase the maximum number."
2015-01-09	Corrected hyperlinks
2014-11-14	Initial Release.

Introduction

This guide provides detailed information about FortiGate VDOMs. It is intended for administrators who need guidance on solutions to suit different network needs and information on basic and advanced configuration of VDOMs. Virtual Domains (VDOMs) multiply the capabilities of your FortiGate unit by using virtualization to partition your resources.

VDOMs enable your FortiGate unit to split its resources and function as multiple independent units with common administration.

This chapter includes the following topics:

- [Before you begin](#)
- [How this guide is organized](#)

Before you begin

Before you begin using this guide, take a moment to note the following:

- By default, most FortiGate units support 10 VDOMs. Many FortiGate models support purchasing a license key to increase the maximum number.
- This guide uses a FortiGate unit with interfaces named port1 through port4 for examples and procedures. The interface names on some models will vary. Where possible aliases for these ports are indicated to show their intended purpose and to help you determine which ports to use if your ports are labelled differently.
- Administrators are assumed to be super_admin administrators unless otherwise specified. Some restrictions will apply to other administrators.

How this guide is organized

This document describes how to implement VLAN technology on FortiGate units operating in both NAT/Route, and Transparent mode. It also describes how to use VDOMs on FortiGate units to provide separate network protection, routing, and VPN configurations.

This FortiOS Handbook chapter contains the following sections:

[Virtual Domains](#) provides an overview of the VDOM technologies, and the basic concepts and rules for using them. We recommend that you begin with this chapter before attempting to configure VDOMs on your FortiGate unit.

[Virtual Domains in NAT/Route mode on page 41](#) provides detailed explanations and examples for configuring VDOM features in your FortiGate unit using the NAT/Route mode.

[Virtual Domains in Transparent mode on page 61](#) provides detailed explanations, as well as basic and advanced examples for configuring these features in your FortiGate unit using Transparent mode.

[Inter-VDOM routing on page 80](#) describes inter-VDOM routing concepts and scenarios, and gives examples that illustrate them.

[Troubleshooting Virtual Domains on page 118](#) provides diagnostic and troubleshooting information for some potential VDOM issues.

Virtual Domains

Virtual domains (VDOMs) are a method of dividing a FortiGate unit into two or more virtual units that function as multiple independent units. VDOMs can provide separate firewall policies and, in NAT/Route mode, completely separate configurations for routing and VPN services for each connected network or organization.

This chapter will cover the basics of VDOMs, how they change your FortiGate unit, and how to work with VDOMs.

VDOMs let you split your physical FortiGate unit into multiple virtual units. The resulting benefits range from limiting Transparent mode ports to simplified administration, to reduced space and power requirements.

When VDOMs are disabled on any FortiGate unit, there is still one VDOM active: the root VDOM. It is always there in the background. When VDOMs are disabled, the root VDOM is not visible but it is still there.

The root VDOM must be there because the FortiGate unit needs a management VDOM for management traffic among other things. It is also why when you enable VDOMs, all your configuration is preserved in the root VDOM—because that is where you originally configured it.

This section includes:

- [Benefits of Virtual Domains](#)
- [Enabling and accessing Virtual Domains](#)
- [Configuring Virtual Domains](#)

Benefits of Virtual Domains

VDOMs provide the following benefits:

- [Improving Transparent mode configuration](#)
- [Easier administration](#)
- [Continued security](#)
- [Savings in physical space and power](#)
- [More flexible MSSP configurations](#)

Improving Transparent mode configuration

When VDOMs are not enabled and you put your FortiGate unit into Transparent mode, all the interfaces on your unit become broadcast interfaces. The problem with this is that there are no interfaces free to do anything else.

With multiple VDOMs you can have one of them configured in Transparent mode, and the rest in NAT/Route mode. In this configuration, you have an available transparent mode FortiGate unit you can drop into your network for troubleshooting, and you also have the standard NAT for networking.

Easier administration

VDOMs provide separate security domains that allow separate zones, user authentication, firewall policies, routing, and VPN configurations. VDOMs separate security domains and simplify administration of complex

configurations—you do not have to manage as many settings at one time. For more information, see [Global and per-VDOM settings](#).

By default, each FortiGate unit has a VDOM named root. This VDOM includes all of the unit's physical interfaces, modem, VLAN subinterfaces, zones, firewall policies, routing settings, and VPN settings.

Also, you can optionally assign an administrator account restricted to one VDOM. If the VDOM is created to serve an organization, this feature enables the organization to manage its own configuration. For more information, see [Administrators in Virtual Domains](#).

Each physical FortiGate unit requires a FortiGuard license to access security updates. VDOMs do not require any additional FortiGuard licenses, or updating — all the security updates for all the VDOMs are performed once per update at the global level. Combined this can be a potentially large money and time saving feature in your network.

Management systems such as SNMP, logging, alert email, FDN-based updates, and NTP-based time setting use addresses and routing in the management VDOM to communicate with the network. They can connect only to network resources that communicate with the management VDOM. Using a separate VDOM for management traffic enables easier management of the FortiGate unit global settings, and VDOM administrators can also manage their VDOMs more easily. For more information, see [Changing the management virtual domain](#).

Continued security

When a packet enters a VDOM, it is confined to that VDOM and is subject to any firewall policies for connections between VLAN subinterfaces or zones in that VDOM, just like those interfaces on a FortiGate unit without VDOMs enabled.

To travel between VDOMs, a packet must first pass through a firewall policy on a physical interface. The packet then arrives at another VDOM on that same FortiGate unit, but on a different interface, where it must pass through another firewall before entering. It doesn't matter if the interface is physical or virtual — inter-VDOM packets still require the same security measures as when passing through physical interfaces.

VDOMs provide an additional level of security because regular administrator accounts are specific to one VDOM — an administrator restricted to one VDOM cannot change information on other VDOMs. Any configuration changes and potential errors will apply only to that VDOM and limit any potential down time. Using this concept, you can farther split settings so that the management domain is only accessible by the super_admin and does not share any settings with the other VDOMs.

Savings in physical space and power

To increase the number of physical FortiGate units, you need more rack space, cables, and power to install the new units. You also need to change your network configuration to accommodate the new physical units. In the future, if you need fewer physical units you are left with expensive hardware that is idle.

Increasing VDOMs involves no additional hardware, no additional cabling, and very few changes to existing networking configurations. VDOMs save physical space and power. You are limited only by the size of the VDOM license you buy and the physical resources on the FortiGate unit.

By default, FortiGate units support a maximum of 10 VDOMs in any combination of NAT/Route and Transparent modes. Many FortiGate models support purchasing a license key to increase the maximum number. For more information on VDOM licences, see [Virtual Domain Licensing](#).

More flexible MSSP configurations

If you are a managed security and service provider (MSSP), VDOMs are fundamental to your business. As a service provider you have multiple customers, each with their own needs and service plans. VDOMs allow you to have a separate configuration for each customer, or group of customers; with up to 500 VDOMs configured per FortiGate unit on high end models. See [Virtual Domain Licensing](#).

Not only does this provide the exact level of service needed by each customer, but administration of the FortiGate unit is easier as well - you can provide uninterrupted service generally with immediate changes as required. Most importantly, it allows you to only use the resources that each customer needs. Inter-VDOM links allow you to customize the level of interaction you need between each of your customers and your administrators. See [Inter-VDOM routing](#).

Enabling and accessing Virtual Domains

While Virtual Domains are essentially the same as your regular FortiGate unit for menu configuration, CLI command structure, and general task flow, there are some small differences.

After first enabling VDOMs on your FortiGate unit, you should take the time to familiarize yourself with the interface. This section will help walk you through virtual domains.

This section includes:

- [Enabling Virtual Domains](#)
- [Viewing the VDOM list](#)
- [Global and per-VDOM settings](#)
- [Resource settings](#)
- [Virtual Domain Licensing](#)
- [Logging in to VDOMs](#)

Enabling Virtual Domains

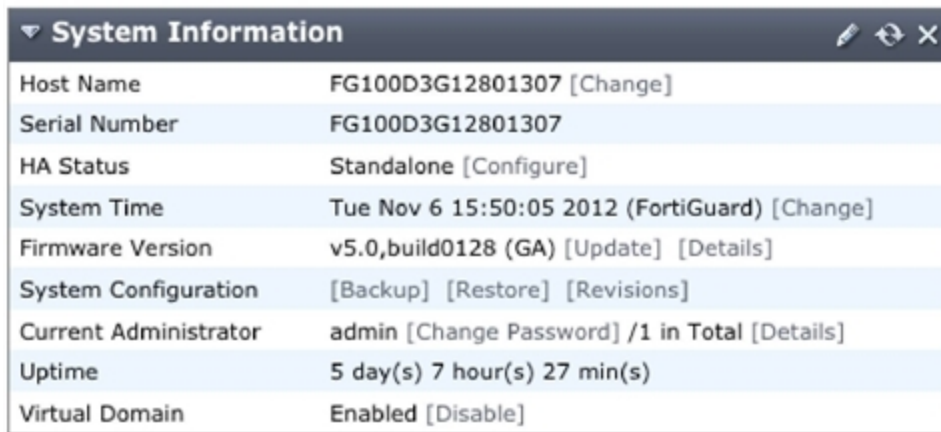
Using the default admin administration account, you can enable or disable VDOM operation on the FortiGate unit.

To enable VDOM configuration - web-based manager:

1. Log in with a super_admin account.
2. Go to **System > Dashboard > Status**.
3. Under **System Information > Virtual Domain**, select **Enable** and confirm your selection.

The FortiGate unit logs off all sessions. You can now log in again as admin. For more information, see [Administrators in Virtual Domains](#).

System Information



Host Name	FG100D3G12801307 [Change]
Serial Number	FG100D3G12801307
HA Status	Standalone [Configure]
System Time	Tue Nov 6 15:50:05 2012 (FortiGuard) [Change]
Firmware Version	v5.0,build0128 (GA) [Update] [Details]
System Configuration	[Backup] [Restore] [Revisions]
Current Administrator	admin [Change Password] /1 in Total [Details]
Uptime	5 day(s) 7 hour(s) 27 min(s)
Virtual Domain	Enabled [Disable]

To enable VDOM configuration - CLI:

```
config system global
    set vdom-admin enable
end
```

Changes to the web-based manager and CLI

When Virtual Domains are enabled, your FortiGate unit will change. The changes will be visible in both the web-based manager and CLI, just the web-based manager, or just the CLI.

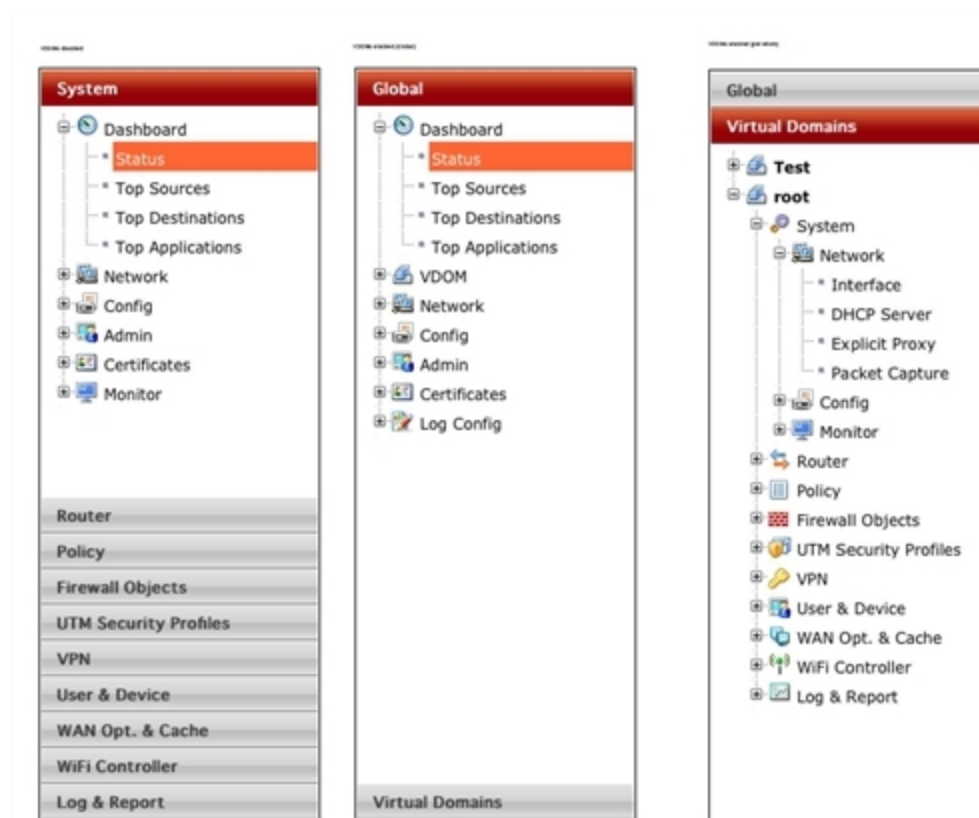
When enabling VDOMs, the web-based manager and the CLI are changed as follows:

- Global and per-VDOM configurations are separated. This is indicated in the Online Help by Global and VDOM icons. See [Global and per-VDOM settings](#).
- Only admin accounts using the super_admin profiles can view or configure global options. See [Administrators in Virtual Domains](#).
- Admin accounts using the super_admin profile can configure all VDOM configurations.
- All other administrator accounts can configure only the VDOM to which they are assigned.

The following changes are specific to the web-based manager:

- In the Global view, the System section of the left-hand menu is renamed to Global, and includes a VDOM sub-menu.
- The Log Config menu is moved from Log & Report into the new Global section.
- For admin accounts using the super_admin profile, a new section called Virtual Domains is added at the bottom of the left-hand menu. It lists all the individual VDOMs as expandable menus, with all VDOM specific options in that menu, which allows you to easily select which VDOM to configure, including the root VDOM. See [Menu with VDOMs disabled, at the global level, and VDOM level](#).

Menu with VDOMs disabled, at the global level, and VDOM level



In the CLI, admin accounts using the super_admin profile must specify either the global or a VDOM-specific shell before entering commands:

- To change FortiGate unit system settings, from the top level you must first enter the following CLI before entering commands:

```
config global
```

- To change VDOM settings, from the top level you must first enter the following CLI before entering commands for that VDOM:

```
config vdom
edit <vdom_na
```

Settings configured outside of a VDOM are called global settings. These settings affect the entire FortiGate unit and include areas such as interfaces, HA, maintenance, some antivirus settings, and some logging settings. In general, any unit settings that should only be changed by the top level administrator are global settings.

Settings configured within a VDOM are called VDOM settings. These settings affect only that specific VDOM and include areas such as operating mode, routing, firewall, VPN, some antivirus, some logging, and reporting.

For more information, see [Global and per-VDOM settings](#).

Viewing the VDOM list

The VDOM list shows all virtual domains, their status, and which VDOM is the management VDOM. It is accessible if you are logged in on an administrator account with the super_admin profile such as the “admin” administrator account.

In the VDOM list you can create or delete VDOMs, edit VDOMs, change the management VDOM, and enable or disable VDOMs.

You can access the VDOM list in **Global > VDOM > VDOM**.



The root domain cannot be disabled, even if it is not the management VDOM.

List of VDOMs

Create New Edit Delete Switch Management [root]						
<input type="checkbox"/>	Name	Operation Mode	Interfaces	Enable	Comments	Ref.
<input type="checkbox"/>	root	NAT	example_wlan , modem , ssl.root , wan1 , wan2 , wlan , wlan_employee	<input checked="" type="checkbox"/>		
<input type="checkbox"/>	vdom1	NAT	dmz , internal , ssl.vdom1	<input checked="" type="checkbox"/>		
<input type="checkbox"/>	vdom2	NAT	ssl.vdom2	<input type="checkbox"/>		

Create New	Select to add a new VDOM. See Creating a Virtual Domain .
Edit	Select to change an existing selected VDOM.
Delete	Select to delete the selected VDOM. See Deleting a VDOM .
Switch Management	<p>Select to switch the management VDOM. Also shows the current management VDOM.</p> <p>You must select an active non-management VDOM before this option becomes available.</p> <p>See Changing the management virtual domain.</p>
Selected	When checked, this checkbox indicates this VDOM has been selected. Nearly all operations such as Edit, Delete, and Switch Management require a VDOM to first be selected.
Name	<p>The name of the VDOM. VDOMs are listed in alphabetical order.</p> <p>When the VDOM is active, you can select the VDOM name to enter that VDOM. See Enabling and accessing Virtual Domains.</p>

Operation Mode	Indicates the operation mode as either NAT (for NAT/Route mode) or TP (for Transparent mode).
Interfaces	The interfaces associated with this VDOM. Each VDOM also includes an interface that starts with "ssl." that is created by default.
Enable	A green checkmark indicates this VDOM is active. See Disabling a Virtual Domain . A grey X indicated this VDOM is disabled. See Disabling a Virtual Domain .
Comments	Comments entered when the VDOM was created are displayed here.
Ref.	The number of references to this VDOM in the configuration.

Global and per-VDOM settings

Settings configured outside of a VDOM are called global settings. These settings affect the entire FortiGate unit and include areas such as interfaces, HA, maintenance, some antivirus, and some logging. In general, any unit settings that should only be changed by the top level administrator are global settings.

Settings configured within a VDOM are called VDOM settings. These settings affect only that specific VDOM and include areas such as operating mode, routing, firewall, VPN, some antivirus, some logging settings, and reporting.

When Virtual Domains are not enabled, the entire FortiGate unit is effectively a single VDOM. Per-VDOM limits apply. For some resource types, the global limit cannot be reached with only one VDOM.

Some FortiGate unit documentation indicates which parts of the web-based manager, or the CLI are global and which are per-VDOM using the icons shown below. These icons are also present in the Online Help, available on your FortiGate unit.

Global and VDOM icons



For more information on CLI commands, see the [FortiGate CLI Reference](#).

This section includes:

- [Global settings - web-based manager](#)
- [Per-VDOM settings - web-based manager](#)
- [Global settings - CLI](#)
- [Per-VDOM settings - CLI](#)

Global settings - web-based manager

The following table lists commands in the web-based manager that are considered global settings when VDOMs are enabled.

The following configuration settings affect all virtual domains. When virtual domains are enabled, only accounts with the default super_admin profile can access global settings.

Global configuration settings

System	Dashboard > Status - Host name
	Dashboard > Status - HA Status
	Dashboard > Status - System Time
	Dashboard > Status - Firmware version
	Dashboard > Status - Configuration backup and restore
	VDOM > VDOM - list
	VDOM > VDOM - edit VDOM (mode and resources)
	VDOM > Global Resources
	Network > Interfaces
	Network > DNS - DNS and DDNS settings
	Config > HA
	Config > SNMP
	Config > Replacement Message - messages and images
	Config > FortiGuard - configuration
	Config > Advanced
	- scripts, USB Auto-install, debug log download
	Config > Messaging Servers
	Admin > Administrators
	Admin > Admin Profile
	Admin > Settings - web administration ports, password policy, display settings, timeouts, LCD panel
	Certificates - local, remote, and CA certificates, CRLs
Log&Report	Log Config - Log Setting

Per-VDOM settings - web-based manager

The following table lists commands in the web-based manager that are considered per-VDOM settings when VDOMs are enabled.

VDOM configuration settings

System	Dashboard > Status - read-only except for administrator password
	Network > Interfaces (and zones)
	Network > DHCP Server
	Network > Explicit Proxy
	Network > Routing Table (Transparent mode only)
	Network > Packet Capture
	Config > Replacement Message (messages and images)
	Config > Advanced
	Monitor > DHCP Monitor
Router	All settings, including dead gateway detection
Policy	All settings
Firewall Objects	All settings
Security Profiles	All settings
VPN	All settings
User & Device	All settings
WiFi Controller	All settings
Log&Report	Traffic and Event Logs
	Reports
	FortiCloud
	Log Config > Log Setting and Alert E-mail
	Logging Monitor

Global settings - CLI

The following table lists commands in the CLI that are considered global settings when VDOMs are enabled.

From a super_admin profile account, use this command to configure features that apply to the complete FortiGate unit including all virtual domains. Virtual domain configuration (vdom-admin) must be enabled first.

This command syntax shows how you access the commands within config global. For information on these commands, refer to the relevant sections in the CLI Reference. If there are multiple versions of the same command with a “2” or “3” added, the additional commands are not listed but fall under the unnumbered command of the same name.

```
config global
  config antivirus heuristic
  config antivirus service
  config application name
  config dlp settings
  config endpoint-control app-detect
  config firewall ssl
  config gui console
  config ips decoder
  config ips global
  config ips rule
  config log fortianalyzer setting
  config log fortiguard setting
  config log memory global-setting
  config log syslogd filter
  config log syslogd setting
  config log webtrends ...
  config spamfilter fortishield
  config spamfilter options
  config system accprofile
  config system admin
  config system auto-install
  config system autoupdate ...
  config system bug-report
  config system central-management
  config system chassis-loadbalance
  config system console
  config system custom-language
  config system ddns
  config system dedicated-mgmt
  config system dns
  config system dscp-based-priority
  config system email-server
  config system fips-cc
  config system fortiguard
  config system fortisandbox
  config system fsso-polling
  config system geoip-override
  config system global
  config system ha
  config system interface
  config system ips-urlfilter-dns
  config system lte-modem
  config system netflow
  config system npu
```

```
config system ntp
config system password-policy
config system physical-switch
config system probe-response
config system replacemsg ...
config system replacemsg-image
config system resource-limits
config system session-helper
config system session-sync
config system sflow
config system sms-server
config system snmp ...
config system storage
config system switch-interface
config system tos-based-priority
config system vdom-link
config system vdom-property
config system vdom-radius-server
config system virtual-switch
config vpn certificate ...
config wanopt storage
config webfilter fortiguard
config webfilter ips-urlfilter-cache-setting
config wireless-controller global
config wireless-controller timers
config wireless-controller vap
execute FortiClient-NAC
execute backup
execute batch
execute central-mgmt
execute cfg reload
execute cfg save
execute cli check-template-status
execute cli status-msg-only
execute date
execute disconnect-admin-session
execute disk
execute enter
execute erase-disk
execute extender
execute factoryreset
execute factoryreset2
execute formatlogdisk
execute forticlient
execute fortiguard-log
execute fortiguard-message
execute ha ignore-hardware-revision
execute log ...
execute policy-packet-capture
execute reboot
execute report-config
execute restore
execute revision
execute router clear
execute send-fds-statistics
execute set system
execute set-next-reboot
```

```
execute sfp-mode-sgmii
execute shutdown
execute switch-controller
execute system
execute tac
execute time

execute update-av
execute update-geo-ip
execute update-ips
execute update-list
execute update-netscan
execute update-now
execute update-src-vis
execute upload
execute usb-disk
execute vpn certificate ...
execute wireless-controller delete-wtp-image
execute wireless-controller list-wtp-image
execute wireless-controller restart-acd
execute wireless-controller upload-wtp-image
get antivirus heuristic
get application name
get dlp settings
get endpoint-control forticlient-registration-sync
get extender modem-status
get extender sys-info
get firewall ipv6-eh-filter
get firewall ssl
get gui console
get hardware cpu
get hardware memory
get hardware nic
get hardware npu
get hardware status
get ips decoder
get ips global
get ips rule
get ips view-map
get log fortianalyzer
get log fortiguard
get log memory
get log syslog
get webtrends
get mgmt-data status
get spamfilter fortishield
get spamfilter options
get system accprofile
get system admin
get system auto-install
get system auto-update
get system autoupdate
get system central-management
get system central-mgmt
get system checksum
get system cmdb
get system console
```

```
get system custom-language
get system ddns
get system dedicated-mgmt
get system dns
get system dscp-based-priority
get system email-server
get system fips-cc
get system fortianalyzer-connectivity
get system fortiguard
get system fortiguard-log-service
get system fortiguard-service
get system fortisandbox
get system fsso-polling
get system geoip-country
get system geoip-override
get system global
get system ha
get system ha-nonsync-csum
get system info
get system interface
get system ips-urlfilter-dns
get system lte-modem
get system mgmt-csum
get system netflow
get system npu
get system ntp
get system password-policy
get system performance
get system physical-switch
get system probe-response
get system replacemsg
get system replacemsg-image
get system resource-limits
get system session-helper
get system session-helper-info
get system session-info
get system session-sync
get system sflow
get system sms-server
get system snmp
get system source-ip
get system startup-error-log
get system status
get system storage
get system switch-interface
get system tos-based-priority
get system vdom-link
get system vdom-property
get system vdom-radius-server
get system virtual-switch
get test <name of daemon>
get user device-category
get vpn certificate
get wanopt storage
get webfilter fortiguard
get webfilter ftgd-statistics
get webfilter ips-urlfilter-cache-setting
```

```
get webfilter status
get wireless-controller client-info
get wireless-controller global
get wireless-controller rf-analysis
get wireless-controller scan
get wireless-controller spectral-info
get wireless-controller status
get wireless-controller timers
get wireless-controller vap
get wireless-controller vap-status
get wireless-controller wtp-status
end
```

Per-VDOM settings - CLI

The following table lists commands in the CLI that are considered VDOM-specific settings when VDOMs are enabled.

From the `super_admin` account, you can use the commands below to add and configure virtual domains. The number of virtual domains you can add is dependent on the FortiGate model. Virtual domain configuration (`vdom-admin`) must be enabled.

Once you add a virtual domain you can configure it by adding zones, firewall policies, routing settings, and VPN settings. You can also move physical interfaces from the root virtual domain to other virtual domains and move VLAN subinterfaces from one virtual domain to another.

By default all physical interfaces are in the root virtual domain. You cannot remove an interface from a virtual domain if the interface is part of any of the following configurations:

- routing
- proxy arp
- DHCP server
- zone
- firewall policy
- redundant pair
- link aggregate (802.3ad) group

Delete these objects, or modify them, to be able to remove the interface.

This command syntax shows how you access the commands within a VDOM. Refer to the relevant sections in this Reference for information on these commands.

```
config vdom
edit <vdom_name>
config antivirus profile
config antivirus quarantine
config antivirus settings
config application list
config application rule-settings
config dlp filepattern
config dlp fp-doc-source
config dlp fp-sensitivity
config dlp sensor
config endpoint-control profile
config endpoint-control settings
config firewall ... (except ssl)
```

```
config ftp-proxy
config icap
config imp2p aim-user
config imp2p icq-user
config imp2p msn-user
config imp2p old-version
config imp2p policy
config imp2p yahoo-user
config ips custom
config ips rule-settings
config ips sensor
config ips settings
config log custom-field
config log disk
config log eventfilter
config log fortianalyzer
config log fortiguard
config log memory
config log setting
config log syslogd
config netscan
config router
config spamfilter bwl
config spamfilter bword
config spamfilter dnsbl
config spamfilter iptrust
config spamfilter mheader
config spamfilter profile
config system 3g-modem
config system admin
config system arp-table
config system dhcp ...
config system dhcp6 ...
config system dns-database
config system dns-server
config system gre-tunnel
config system interface
config system ipip-tunnel
config system ipv6-neighbor-cache
config system ipv6-tunnel
config system modem ..
config system monitors
config system nat64
config system network-visibility
config system object-tag
config system proxy-arp
config system replacemsg-group
config system server-probe
config system session-ttl
config system settings
config system sit-tunnel
config system switch-interface
config system wccp
config system zone
config user ...
config voip
config vpn ...
```



```
config wanopt auth-group
config wanopt peer
config wanopt profile
config wanopt settings
config wanopt ssl-server
config wanopt webcache
config web-proxy debug-url
config web-proxy explicit
config web-proxy forward-server
config web-proxy forward-server-group
config web-proxy global
config web-proxy url-match
config webfilter content
config webfilter content-header
config webfilter ftgd-local-cat
config webfilter ftgd-local-rating
config webfilter ftgd-local-warning
config webfilter ips-urlfilter-setting
config webfilter override
config webfilter override-user
config webfilter profile
config webfilter search-engine
config webfilter urlfilter
config wireless-controller ap-status
config wireless-controller setting
config wireless-controller vap
config wireless-controller sids-profile
config wireless-controller wtp
config wireless-controller wtp-profile
execute backup
execute clear system arp table
execute cli check-template-status
execute cli status-msg-only
execute client-reputation
execute dhcp lease-clear
execute dhcp lease-list
execute dhcp6 lease-clear
execute dhcp6 lease-list
execute enter
execute fortitoken ...
execute fortitoken-mobile
execute fsso refresh
execute interface dhcpclient-renew
execute interface pppoe-reconnect
execute log ...
execute log-report reset
execute modem dial
execute modem hangup
execute modem trigger
execute mrouter clear
execute netscan ...
execute ping, ping6
execute ping-options, ping6-options
execute policy-packet-capture
execute report
execute report-config
execute restore
```

```
execute revision
execute router clear
execute sfp-mode-smii
execute ssh
execute switch-controller
execute tac
execute telnet
execute traceroute
execute tracert6
execute upload
execute usb-device
execute usb-disk
execute vpn ipsec tunnel
execute vpn sslvpn ...
execute wireless-controller reset-wtp
next
edit <another_vdom>
  config ...
  execute ...
end
```

For more information, see [Global and per-VDOM settings](#).

Resource settings

Your FortiGate unit has a limited amount of hardware resources such as memory, disk storage, CPU operations. When Virtual Domains are disabled, this limit is not a major concern because all sessions, users, and other processes share all the resources equally.

When using Virtual Domains, hardware resources can be divided differently between Virtual Domains as they are needed. Minimum levels of resources can be specified for each VDOM, so that no Virtual Domain will suffer a complete lack of resources.

For example, if one VDOM has only a web server and logging server connected, and a second VDOM has an internal network of 20 users, these two VDOMs will require different levels of resources. The first VDOM will require many sessions but no user accounts. This compares to the second VDOM where user accounts and management resources are required, but fewer sessions.

Using the global and per-VDOM resource settings, you can customize the resources allocated to each VDOM to ensure the proper level of service is maintained on each VDOM.

This section includes:

- [Global resource settings](#)
- [Per-VDOM resource settings](#)

Global resource settings

Global Resources apply to the whole FortiGate unit. They represent all of the hardware capabilities of your unit. By default the values are set to their maximum values. These values vary by your model due to each model having differing hardware capabilities.



It can be useful to change the maximum values for some resources to ensure there is enough memory available for other resources that may be more important to your configuration.

To use the earlier example, if your FortiGate unit is protecting a number of web servers and other publicly accessible servers you would want to maximize the available sessions and proxies while minimizing other settings that are unused such as user settings, VPNs, and dial-up tunnels.

Global Resources are only configurable at the global level, and only the admin account has access to these settings.

Note that global resources, such as the log disk quota resource, will only be visible if your FortiGate unit hardware supports those resources, such as having a hard disk to support the log disk resource.

Global Resources- web-based manager

 Edit  Reset to default value				
<input type="checkbox"/>	Resource	Configured Maximum	Default Maximum	Current Usage
<input type="checkbox"/>	Sessions	0	0	26
<input type="checkbox"/>	VPN IPsec Phase1 Tunnels	10000	10000	0
<input type="checkbox"/>	VPN IPsec Phase2 Tunnels	10000	10000	0
<input type="checkbox"/>	Dial-up Tunnels	0	0	0
<input type="checkbox"/>	Firewall Policies	100000	100000	3
<input type="checkbox"/>	Firewall Addresses	20000	20000	11
<input type="checkbox"/>	Firewall Address Groups	10000	10000	0
<input type="checkbox"/>	Firewall Custom Services	0	0	0
<input type="checkbox"/>	Firewall Service Groups	0	0	0
<input type="checkbox"/>	Firewall One-time Schedules	0	0	0
<input type="checkbox"/>	Firewall Recurring Schedules	0	0	5
<input type="checkbox"/>	Local Users	0	0	0
<input type="checkbox"/>	User Groups	0	0	0
<input type="checkbox"/>	SSL VPN	0	0	0
<input type="checkbox"/>	Concurrent web proxy users	2000	2000	0
<input type="checkbox"/>	log disk quota	0	0	0

To view global resource settings - web-based manager:

1. Select **Global > VDOM > Global Resources**.

The following information is displayed:

Edit	Select to edit the Configured Maximum value for a single selected Resource . If multiple Resources are selected, Edit is not available.
Reset to default value	Select to return one or more selected Resources to factory default settings.
Checkbox	Select a Resource for editing or resetting to default values.
Resource	The name of the available global resources.
Configured Maximum	The currently configured maximum for this resource. This value can be changed by selecting the Resource and editing it.
Default Maximum	The factory configured maximum value for this resource. You cannot set the Configured Maximum higher than the Default Maximum .

Current Usage

The amount of this resource that is currently being used. This value is useful for determining when and if you may need to adjust **Configured Maximum** values for some resources on your FortiGate unit.

To view global resource settings - CLI:

```
config global
  config system resource-limits
  get
```

When viewing the global resource limits in the CLI, the output appears similar to:

```
FGT1000A (global) # config system resource-limits
FGT1000A (resource-limits) # get

session : 0
ipsec-phase1 : 10000
ipsec-phase2 : 10000
dialup-tunnel : 0
firewall-policy : 100000
firewall-address : 20000
firewall-addrgrp : 10000
custom-service : 0
service-group : 0
onetime-schedule : 0
recurring-schedule : 0
user : 0
user-group : 0
sslvpn : 0
proxy : 2000
```



For explicit proxies, when configuring limits on the number of concurrent users, you need to allow for the number of users based on their authentication method. Otherwise you may run out of user resources prematurely.

Each session-based authenticated user is counted as a single user using their authentication membership (RADIUS, LDAP, FSAE, local database etc.) to match users in other sessions. So one authenticated user in multiple sessions is still one user.

For all other situations, the source IP address is used to determine a user. All sessions from a single source address are assumed to be from the same user.

Per-VDOM resource settings

While Global resources apply to resources shared by the whole FortiGate unit, per-VDOM resources are specific to only one Virtual Domain.

By default all the per-VDOM resource settings are set to no limits. This means that any single VDOM can use up all the resources of the entire FortiGate unit if it needs to do so. This would starve the other VDOMs for resources to the point where they would be unable to function. For this reason, it is recommended that you set some maximums on resources that are most vital to your customers.

Each Virtual Domain has its own resource settings. These settings include both maximum, and minimum levels. The maximum level is the highest amount of that resource that this VDOM can use if it is available on the FortiGate unit. Minimum levels are a guaranteed level that this minimum level of the resource will always be available no matter what the other VDOMs may be using.

Figure 6: Per-VDOM resources - web-based manager:

Resource Usage

Resource	Maximum	Guaranteed	Current
Sessions	0	0	24
VPN IPsec Phase1 Tunnels	0	0	0
VPN IPsec Phase2 Tunnels	0	0	0
Dial-up Tunnels	0	0	0
Firewall Policies	0	0	3
Firewall Addresses	0	0	3
Firewall Address Groups	0	0	0
Firewall Custom Services	0	0	0
Firewall Service Groups	0	0	0
Firewall One-time Schedules	0	0	0
Firewall Recurring Schedules	0	0	1
Local Users	0	0	0
User Groups	0	0	0
SSL VPN	0	0	0
Concurrent web proxy users	0	0	0
log disk quota	0	0	0

For example, consider a FortiGate unit that has ten VDOMs configured. vdom1 has a maximum of 5000 sessions and a minimum of 1000 sessions. If the FortiGate unit has a global maximum of 20,000 sessions, it is possible that vdom1 will not be able to reach its 5000 session upper limit. However, at all times vdom1 is guaranteed to have 1000 sessions available that it can use. On the other hand, if the remaining nine VDOMs use only 1000 sessions each, vdom1 will be able to reach its maximum of 5000.

To view per-VDOM resource settings - web-based manager:

1. Select **Global > VDOM > VDOM**.
2. Select the `root` VDOM, and select **Edit**.
3. Adjust the settings in the **Resource Usage** section of the page.

Resource	Name of the resource. Includes dynamic and static resources.
Maximum	<p>Override the global limit to reduce the amount of each resource available for this VDOM. The maximum must be the same as or lower than the global limit. The default value is 0, which means the maximum is the same as the global limit.</p> <p>Note: If you set the maximum resource usage for a VDOM you cannot reduce the default maximum global limit for all VDOMs below this maximum.</p>
Guaranteed	Enter the minimum amount of the resource available to this VDOM regardless of usage by other VDOMs. The default value is 0, which means that an amount of this resource is not guaranteed for this VDOM.
Current	The amount of the resource that this VDOM currently uses.

4. Select **OK**.

To view per-VDOM resource settings - CLI:

```
config global
  config system vdom-property
    edit root
  get
```

When viewing the per-VDOM resource limits in the CLI, the output appears similar to the following. Note that the first two lines are not part of the resource limits. In the CLI, the first number is the maximum value, and the second number is the guaranteed minimum.

```
FGT1KA3607500810 (vdom-property) # edit root
FGT1KA3607500810 (root) # get

name : root
description : property limits for vdom root
session : 0 0
ipsec-phase1 : 0 0
ipsec-phase2 : 0 0
dialup-tunnel : 0 0
firewall-policy : 0 0
firewall-address : 0 0
firewall-addrgrp : 0 0
custom-service : 0 0
service-group : 0 0
onetime-schedule : 0 0
recurring-schedule : 0 0
user : 0 0
user-group : 0 0
```

```
sslvpn : 0 0  
proxy : 0 0
```

Virtual Domain Licensing

Many FortiGate models support purchasing a license key to increase the maximum number. For specific information about the number of VDOM licenses that your FortiGate supports, see the product data sheet.

Configuring 500 or more VDOMs will result in reduced system performance. See [FortiGate unit running very slowly](#).



Your FortiGate unit has limited resources that are divided among all configured VDOMs. These resources include system memory and CPU. Running security features on many VDOMs at once can limit resources available for basic processing. If you require many VDOMs, all with active security features, it is recommended to upgrade to a more powerful FortiGate unit.



It is important to backup your configuration before upgrading the VDOM license on your FortiGate unit or units, especially with FortiGate units in HA mode.

To obtain a VDOM license key

1. Log in with a super_admin account.
2. Go to **System > Dashboard > Status**.
3. Record your FortiGate unit serial number as shown in [System Information](#).
4. Under **License Information > Virtual Domain**, select **Purchase More**.



If you do not see the **Purchase More** option on the System Dashboard, your FortiGate model does not support more than 10 VDOMs.

VDOM License Information

License Information		
Support Contract		
Registration	Unreachable	?
FortiGuard Services		
AntiVirus	Unreachable [Configure]	?
AV Definitions	9.00795 (Updated 2008-12-08) [Update]	
Extended set	0.00000 (Updated 2003-01-01)	
Intrusion Protection	Unreachable [Configure]	?
IPS Definitions	2.00720 (Updated 2009-12-01) [Update]	
Vulnerability Compliance and Management	Unreachable [Configure]	?
VCM Plugin	1.00098 (Updated 2010-02-11) [Update]	
Web Filtering	Unreachable [Configure]	?
Email Filtering	Unreachable [Configure]	?
Analysis & Management Service	Unreachable	?
Services Account ID	[Change]	
Virtual Domain		
VDOMs Allowed	10 [Purchase More]	
Endpoint Security		
FortiClient Software	Unreachable	
Application Signature Package	1.131 (Updated 2010-02-16)	

5. You will be taken to the Fortinet customer support website where you can log in and purchase a license key for 25, 50, 100, 250, 500, or more VDOMs.
6. When you receive your license key, go to the Dashboard and select **Upload License** under **License Information, Virtual Domains**.
7. In the **Input License Key** field, enter the 32-character license key you received from Fortinet customer support.
8. Select **Apply**.

To verify the new VDOM license, in global configuration go to **System > Dashboard**. Under **License Information, Virtual Domains** the maximum number of VDOMs allowed is shown.



VDOMs created on a registered FortiGate unit are recognized as real devices by any connected FortiAnalyzer unit. The FortiAnalyzer unit includes VDOMs in its total number of registered devices. For example, if three FortiGate units are registered on the FortiAnalyzer unit and they contain a total of four VDOMs, the total number of registered FortiGate units on the FortiAnalyzer unit is seven. For more information, see the [FortiAnalyzer Administration Guide](#).

Logging in to VDOMs

Only super_admin administrator accounts can access all global settings on the FortiGate unit and all of the VDOMs as well. Other administrator accounts can access and configure only their single VDOM and they must connect to an interface that is part of that VDOM. For example, administratorB is the admin for vdomB. If he tries to log into vdomA, or an interface that is part of vdomA he will not be able to log on. For more information on administrators in VDOMs, see [Administrators in Virtual Domains](#).

Management services communicate using the management VDOM, which is the root VDOM by default. For more information, see [Changing the management virtual domain](#).



Management traffic requires an interface that has access to the Internet. If there is no interface assigned to the VDOM containing the management traffic, services including updates will not function. For more information, see [Changing the management virtual domain](#).

To access a VDOM with a super_admin account - web-based manager:

1. Log in with a super_admin account.
2. In the **Virtual Domains** menu on the left-hand side, select the VDOM to configure. The menu will expand to show the various pages and settings for that VDOM.
3. When you have finished configuring the VDOM, you can
 - open the **Global** menu to return to global configuration
 - log out

To access a VDOM with a super_admin account - CLI:

With the super_admin, logging into the CLI involves also logging into the specific VDOM. If you need a reminder, use `edit ?` to see a list of existing VDOMs before you editing a VDOM.



If you misspell a VDOM you are trying to switch to, you will create a new VDOM by that name. Any changes you make will be part of the new VDOM, and not the intended VDOM. If you are having problems where your changes aren't visible, back up to the top level and use `edit ?` to see a list of VDOMs to ensure this has not happened. If it has happened, see [Deleting a VDOM](#).

```
config vdom
edit ?
edit <chosen_vdom>
..
<enter vdom related commands>
..
end
exit
```

To access a VDOM with a non super_admin account - web-based manager:

1. Connect to the FortiGate unit using an interface that belongs to the VDOM to be configured.
2. Log in using an administrator account that has access to the VDOM. The main web-based manager page opens. The interface is largely the same as if the device has VDOMs disabled. From here you can access VDOM-specific settings.

To access a VDOM with a non-super_admin account - CLI:

A non-super_admin account has access to only one VDOM and must log in through an interface that belongs to the same VDOM, but the process is the same as logging into a non-VDOM unit.

```
Login: regular_admin
Password: <password>
..
<enter vdom related commands>
..
exit
```

Configuring Virtual Domains

Only a super_admin administrator account such as the default “admin” account can create, disable, or delete VDOMs. That account can create additional administrators for each VDOM.

This section includes:

- [Creating a Virtual Domain](#)
- [Disabling a Virtual Domain](#)
- [Deleting a VDOM](#)
- [Administrators in Virtual Domains](#)

Creating a Virtual Domain

Once you have enabled Virtual Domains on your FortiGate unit, you can create additional Virtual Domains beyond the default root Virtual Domain.

By default new Virtual Domains are set to NAT/Route operation mode. If you want a Virtual Domain to be in Transparent operation mode, you must manually change it. See [Virtual Domains in Transparent mode](#).

You can name new Virtual Domains as you like with the following restrictions:

- only letters, numbers, “-”, and “_” are allowed
- no more than 11 characters are allowed
- no spaces are allowed
- VDOMs cannot have the same names as interfaces, zones, switch interfaces, or other VDOMs.



When creating large numbers of VDOMs you should not enable advanced features such as proxies, web filtering, and antivirus due to limited FortiGate unit resources. Also when creating large numbers of VDOMs, you may experience reduced performance for the same reason.

To create a VDOM - web-based manager:

1. Log in with a super_admin account.
2. Go to **System > Dashboard > Status** and ensure that Virtual Domains are enabled. If not, see [Enabling and accessing Virtual Domains](#).
3. Select **System > VDOM > VDOM**.
4. Select **Create New**.
5. Enter a unique name for your new VDOM.
6. Enter a short and descriptive comment to identify this VDOM.
7. Select **OK**.

Repeat Steps 4 through 7 to add additional VDOMs.

To create a VDOM - CLI:

```
config vdom
  edit <new_vdom_name>
```

end



If you want to edit an existing Virtual Domain in the CLI, and mistype the name a new Virtual Domain will be created with this new misspelled name. If you notice expected configuration changes are not visible, this may be the reason. You should periodically check your VDOM list to ensure there are none of these misspelled VDOMs present.

Disabling a Virtual Domain

The status of a VDOM can be Enabled, or Disabled.

Active status VDOMs can be configured. Active is the default status when a VDOM is created. The management VDOM must be an Active VDOM. For more information on the management VDOM, see [Changing the management virtual domain](#).

Disabled status VDOMs are considered “offline”. The configuration remains, but you cannot use the VDOM, and only the super_admin administrator can view it. You cannot delete a disabled VDOM without first enabling it, and removing references to it like usual—there is no **Delete** icon for disabled status VDOMs. You can assign interfaces to a disabled VDOM. See [Deleting a VDOM](#).

The following procedures show how to disable a VDOM called “test-vdom”.

To disable a VDOM - web-based manager:

1. Go to **Global > VDOM > VDOM**.
2. Open the VDOM for editing.
3. Ensure **Enable** is not selected and then select **OK**.
The VDOM's Enable icon in the VDOM list is a grey X.

To disable a VDOM - CLI:

```
config vdom
  edit test-vdom
    config system settings
      set status disable
    end
end
```

To enable a VDOM - web-based manager:

1. Go to **Global > VDOM > VDOM**.
2. Open the VDOM for editing.
3. Ensure **Enable** is selected and then select **OK**.
The VDOM's Enable icon in the VDOM list is a green checkmark.

To enable a VDOM - CLI:

```
config vdom
  edit test-vdom
    config system settings
      set status enable
    end
end
```

Deleting a VDOM

Deleting a VDOM removes it from the FortiGate unit configuration.

Before you can delete a VDOM, all references to it must be removed. This includes any objects listed in [Per-VDOM settings - web-based manager](#). If there are any references to the VDOM remaining, you will see an error message and not be able to delete the VDOM.

The VDOM must also be enabled. A disabled VDOM cannot be deleted. You cannot delete the root VDOM or the management VDOM.



Before deleting a VDOM, a good practice is to reset any interface referencing that VDOM to its default configuration, with “root” selected as the Virtual Domain.

The following procedures show how to delete the `test-vdom` VDOM.

To delete a VDOM - web-based manager:

1. Go to **Global > VDOM > VDOM**.
2. Select the check box for the VDOM and then select the **Delete** icon.

If the **Delete** icon is not active, there are still references to the VDOM that must first be removed. The **Delete** icon is available when all the references to this VDOM are removed.

3. Confirm the deletion.

To delete a VDOM - CLI:

```
config vdom
    delete test-vdom
end
```

Removing references to a VDOM

When you are going to delete a VDOM, all references to that VDOM must first be removed. It can be difficult to find all the references to the VDOM. This section provides a list of common objects that must be removed before a VDOM can be deleted, and a CLI command to help list the dependencies.

Interfaces are an important part of VDOMs. If you can move all the interfaces out of a VDOM, generally you will be able to delete that VDOM.

Common objects that refer to VDOMs

When you are getting ready to delete a VDOM check for, and remove the following objects that refer to that VDOM or its components:

- Routing - both static and dynamic routes
- Firewall addresses, policies, groups, or other settings
- Security Features/Profiles
- VPN configuration

- Users or user groups
- Logging
- DHCP servers
- Network interfaces, zones, custom DNS servers
- VDOM Administrators

Administrators in Virtual Domains

When Virtual Domains are enabled, permissions change for administrators. Administrators are now divided into per-VDOM administrators, and `super_admin` administrators. Only `super_admin` administrator accounts can create other administrator accounts and assign them to a VDOM.

This section includes:

- [Administrator VDOM permissions](#)
- [Creating administrators for Virtual Domains](#)
- [Virtual Domain administrator dashboard display](#)

Administrator VDOM permissions

Different types of administrator accounts have different permissions within VDOMs. For example, if you are using a `super_admin` profile account, you can perform all tasks. However, if you are using a regular admin account, the tasks available to you depend on whether you have read only or read/write permissions. The following table shows what tasks can be performed by which administrators.

Table 3: Administrator VDOM permissions

Tasks	Regular administrator account		Super_admin profile administrator account
	Read only permission	Read/write permission	
View global settings	yes	yes	yes
Configure global settings	no	no	yes
Create or delete VDOMs	no	no	yes
Configure multiple VDOMs	no	no	yes
Assign interfaces to a VDOM	no	no	yes
Revision Control Backup and Restore	no	no	yes
Create VLANs	no	yes - for 1 VDOM	yes - for all VDOMs

Assign an administrator to a VDOM	no	no	yes
Create additional admin accounts	no	yes - for 1 VDOM	yes - for all VDOMs
Create and edit protection profiles	no	yes - for 1 VDOM	yes - for all VDOMs

The only difference in admin accounts when VDOMs are enabled is selecting which VDOM the admin account belongs to. Otherwise, by default the administration accounts are the same as when VDOMs are disabled and closely resemble the `super_admin` account in their privileges.

Creating administrators for Virtual Domains

Using the admin administrator account, you can create additional administrator accounts and assign them to VDOMs.



The newly-created administrator can access the FortiGate unit only through network interfaces that belong to their assigned VDOM or through the console interface. The network interface must be configured to allow management access, such as HTTPS and SSH. Without these in place, the new administrator will not be able to access the FortiGate unit and will have to contact the `super_admin` administrator for access.

The following procedure creates a new Local administrator account called `admin_sales` with a password of `fortinet` in the `sales` VDOM using the `admin_prof` default profile.

To create an administrator for a VDOM - web-based manager:

1. Log in with a `super_admin` account.
2. Go to **System > Admin > Administrators**.
3. Select **Create New**.
4. Select **Regular** for Type, as you are creating a Local administrator account.
5. Enter the necessary information about the administrator: email, password, etc.
6. If this admin will be accessing the VDOM from a particular IP address or subnet, enable **Restrict this Admin Login from Trusted Hosts Only** and enter the IP in **Trusted Host #1**. See [Using trusted hosts](#).
7. Select `prof_admin` for the **Admin Profile**.
8. Select `sales` from the list of **Virtual Domains**.
9. Select **OK**.

To create administrators for VDOMs - CLI:

```
config global
  config system admin
    edit <new_admin_name>
      set vdom <vdom_for_this_account>
      set password <pwd>
      set accprofile <an_admin_profile>
      ...
    end
```

Using trusted hosts

Setting trusted hosts for all of your administrators increases the security of your network by further restricting administrative access. In addition to knowing the password, an administrator must connect only through the subnet or subnets you specify. You can even restrict an administrator to a single IP address if you define only one trusted host IP address with a netmask of 255.255.255.255.

When you set trusted hosts for all administrators, the FortiGate unit does not respond to administrative access attempts from any other hosts. This provides the highest security. If you leave even one administrator unrestricted, the unit accepts administrative access attempts on any interface that has administrative access enabled, potentially exposing the unit to attempts to gain unauthorized access.

The trusted hosts you define apply both to the web-based manager and to the CLI when accessed through Telnet or SSH. CLI access through the console is not affected.

The trusted host addresses all default to 0.0.0.0/0.0.0.0 for IPv4, or ::/0 for IPv6. If you set one of the zero addresses to a non-zero address, the other zero addresses will be ignored. The only way to use a wildcard entry is to leave the trusted hosts at 0.0.0.0/0.0.0.0 or ::/0. However, this configuration is less secure.

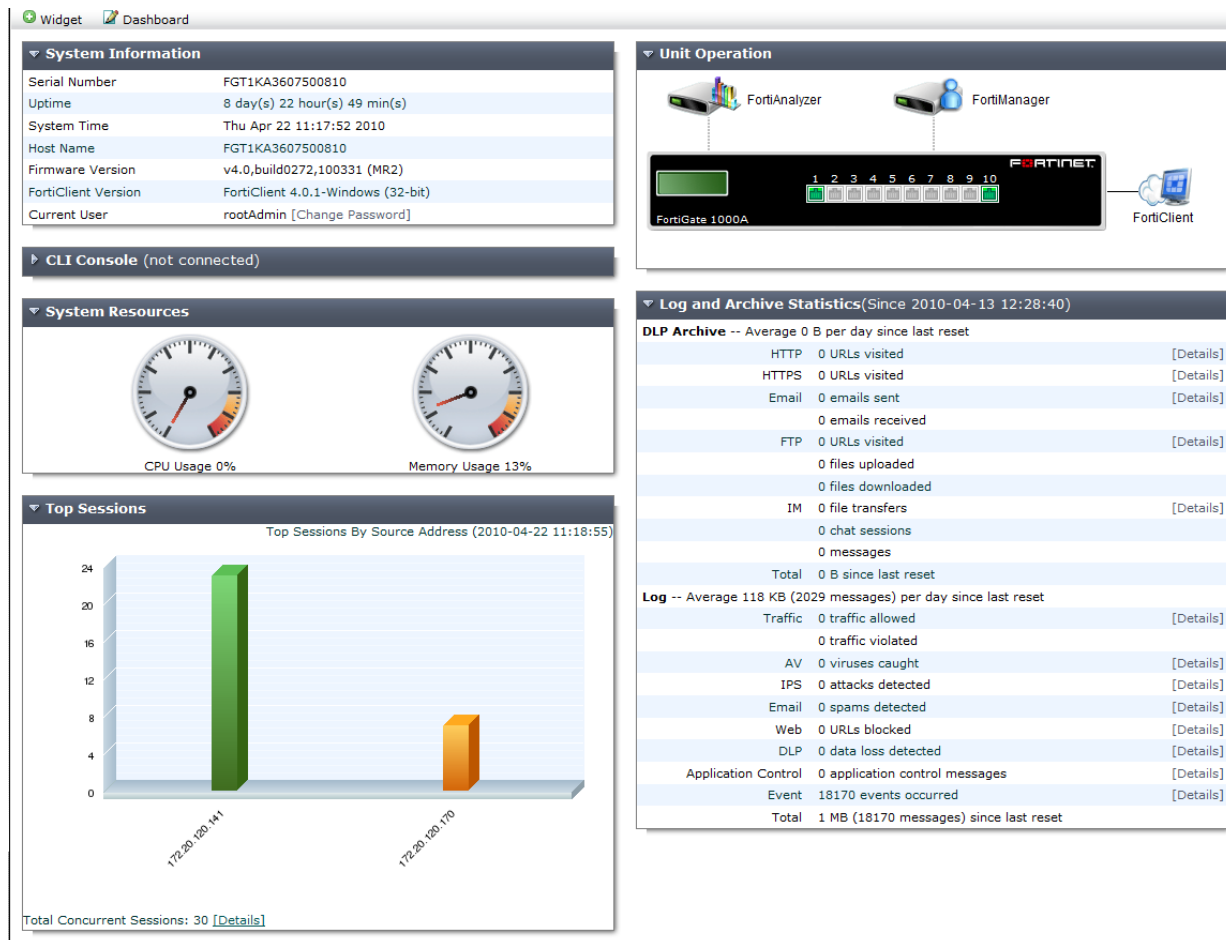
Virtual Domain administrator dashboard display

When administrators logs into their virtual domain, they see a different dashboard than the global administrator will see. The VDOM dashboard displays information only relevant to that VDOM — no global or other VDOM information is displayed.

Table 4: VDOM dashboard information

Information	per-VDOM	Global
System Information	read-only	yes
License Information	no	yes
CLI console	yes	yes
Unit Operation	read-only	yes
Alert Message Console	no	yes
Top Sessions	limited to VDOM sessions	yes
Traffic	limited to VDOM interfaces	yes
Statistics	yes	yes

VDOM administrator dashboard



Virtual Domains in NAT/Route mode

Virtual domains (VDOMs) are a method of dividing a FortiGate unit into two or more virtual units that each function as independent units. Each virtual domain has separate routing and security policies. A single FortiGate unit with virtual domains is flexible enough to serve multiple departments of an organization, separate organizations, or be the basis for a service provider's managed security service.



The examples in this chapter are intended to be followed in order as procedures build on previous procedures. If you do not complete the previous procedures, the procedure you are working on may not work properly. If this happens, consult previous procedures or FortiGate documentation.

This chapter contains the following sections:

- [Virtual domains in NAT/Route mode](#)
- [Example NAT/Route VDOM configuration](#)
- [Figure 9: Example VDOM configuration](#)

Virtual domains in NAT/Route mode

Once you have enabled virtual domains and created one or more VDOMs, you need to configure them. Configuring VDOMs on your FortiGate unit includes tasks such as the ones listed here; while you may not require all for your network topology, it is recommended that you perform them in the order given:

- [Changing the management virtual domain](#)
- [Configuring interfaces in a NAT/Route VDOM](#)
- [Configuring VDOM routing](#)
- [Configuring security policies for NAT/Route VDOMs](#)
- [Configuring security profiles for NAT/Route VDOMs](#)

Changing the management virtual domain

The management virtual domain is the virtual domain where all the management traffic for the FortiGate unit originates. This management traffic needs access to remote servers, such as FortiGuard services and NTP, to perform its duties. It needs access to the Internet to send and receive this traffic.

Management traffic includes, but is not limited to

- DNS lookups
- logging to FortiAnalyzer or syslog
- FortiGuard service
- sending alert emails
- Network time protocol traffic (NTP)
- Sending SNMP traps
- Quarantining suspicious files and email.

By default the management VDOM is the root domain. When other VDOMs are configured on your FortiGate unit, management traffic can be moved to one of these other VDOMs.

Reasons to move the management VDOM include selecting a non-root VDOM to be your administration VDOM, or the root VDOM not having an interface with a connection to the Internet.



You cannot change the management VDOM if any administrators are using RADIUS authentication.

The following procedure will change the management VDOM from the default `root` to a VDOM named `mgmt_vdom`. It is assumed that `mgmt_vdom` has already been created and has an interface that can access the Internet.

To change the management VDOM - web-based manager:

1. Select **Global > VDOM > VDOM**.
2. Select the checkbox next to the required VDOM.
3. Select **Switch Management**.

The current management VDOM is shown in square brackets, “[root]” for example.

To change the management VDOM - CLI:

```
config global
  config system global
    set management-vdom mgmt_vdom
  end
```

Management traffic will now originate from `mgmt_vdom`.

Configuring interfaces in a NAT/Route VDOM

A VDOM must contain at least two interfaces to be useful. These can be physical interfaces or VLAN interfaces. By default, all physical interfaces are in the root VDOM. When you create a new VLAN, it is in the root VDOM by default.

When there are VDOMs on the FortiGate unit in both NAT and Transparent operation modes, some interface fields will be displayed as “-” on **System > Network > Interfaces**. Only someone with a `super_admin` account can view all the VDOMs.



When moving an interface to a different VDOM, firewall IP pools and virtual IPs for this interface are deleted. You should manually delete any routes that refer to this interface. Once the interface has been moved to the new VDOM, you can add these services to the interface again.



When configuring VDOMs on FortiGate units with accelerated interfaces you must assign both interfaces in the pair to the same VDOM for those interfaces to retain their acceleration. Otherwise they will become normal interfaces.

This section includes the following topics:

- [Adding a VLAN to a NAT/Route VDOM](#)
- [Moving an interface to a VDOM](#)
- [Deleting an interface](#)
- [Adding a zone to a VDOM](#)

Adding a VLAN to a NAT/Route VDOM

The following example shows one way that multiple companies can maintain their security when they are using one FortiGate unit with VLANs that share interfaces on the unit.

This procedure will add a VLAN interface called `client1-v100` with a VLAN ID of 100 to an existing VDOM called `client1` using the physical interface called `port2`.



The physical interface does not need to belong to the VDOM that the VLAN belongs to.

To add a VLAN subinterface to a VDOM - web-based manager:

1. Go to **Global > Network > Interfaces**.
2. Select **Create New**.
3. Enter the following information and select **OK**:

Name	client1-v100
Interface	port2
VLAN ID	100
Virtual Domain	Client1
Addressing mode	Manual
IP/Netmask	172.20.120.110/255.255.255.0
Administrative Access	HTTPS, SSH

You will see an expand arrow added to the port2 interface. When the arrow is expanded, the interface shows the `client1-v100` VLAN subinterface.

To add a VLAN subinterface to a VDOM - CLI:

```
config global
  config system interface
```

```
edit client1-v100
    set type vlan
    set vlanid 100
    set vdom Client1
    set interface port2
    set ip 172.20.120.110 255.255.255.0
    set allowaccess https ssh
end
```

Moving an interface to a VDOM

Interfaces belong to the root VDOM by default. Moving an interface is the same procedure no matter if its moving from the root VDOM or a any other VDOM.

If you have an accelerated pair of physical interfaces both interfaces must be in the same VDOM or you will lose their acceleration.

The following procedure will move the port3 interface to the Client2 VDOM. This is a common action when configuring a VDOM. It is assumed that the Client2 VDOM has already been created. It is also assumed that your FortiGate unit has a port3 interface. If you are using a different model, your physical interfaces may not be named port2, external or port3.

To move an existing interface to a different VDOM - web-based manager:

1. Go to **Global > Network > Interfaces**.
2. Select **Edit** for the port3 interface.
3. Select **Client2** as the new **Virtual Domain**.
4. Select **OK**.

To move an existing interface to a different VDOM - CLI:

```
config global
    config system interface
        edit port3
            set vdom Client2
        end
```

Deleting an interface

Before you can delete a virtual interface, or move an interface from one VDOM to another, all references to that interface must be removed. For a list of objects that can refer to an interface see [Per-VDOM settings - web-based manager](#).

The easiest way to be sure an interface can be deleted is when the Delete icon is no longer greyed out. If it remains greyed out when an interface is selected, that interface still has objects referring to it, or it is a physical interface that cannot be deleted.

To delete a virtual interface - web-based manager:

1. Ensure all objects referring to this interface have been removed.
2. Select **Global > Network > Interfaces**.
3. Select the interface to delete.
4. Select the delete icon.

Adding a zone to a VDOM

Grouping interfaces and VLAN subinterfaces into zones simplifies policy creation. You can configure policies for connections to and from a zone, but not between interfaces in a zone.

Zones are VDOM-specific. A zone cannot be moved to a different VDOM. Any interfaces in a zone cannot be used in another zone. To move a zone to a new VDOM requires deleting the current zone and re-creating a zone in the new VDOM.

The following procedure will create a zone called `accounting` in the `client2` VDOM. It will not allow intra-zone traffic, and both `port3` and `port2` interfaces belong to this zone. This is a method of grouping and isolating traffic over particular interfaces—it is useful for added security and control within a larger network.

To add a zone to a VDOM - web-based manager:

1. In **Virtual Domains**, select the `client2` VDOM.
2. Go to **System > Network > Interfaces**.
3. Select **Create New > Zone**.
4. Enter the following information and select **OK**:

Zone Name	accounting
Block intra-zone traffic	Select
Interface Members	port3, port2

To add a zone to a VDOM - CLI:

```
config vdom
  edit client2
    config system zone
      edit accounting
        set interface port3 port2
        set intrazone deny
      end
    end
  end
```

Configuring VDOM routing

Routing is VDOM-specific. Each VDOM should have a default static route configured as a minimum. Within a VDOM, routing is the same as routing on your FortiGate unit without VDOMs enabled.

When configuring dynamic routing on a VDOM, other VDOMs on the FortiGate unit can be neighbors. The following topics give a brief introduction to the routing protocols, and show specific examples of how to configure dynamic routing for VDOMs. Figures are included to show the FortiGate unit configuration after the successful completion of the routing example.

This section includes:

- [Default static route for a VDOM](#)
- [Dynamic Routing in VDOMs](#)

Default static route for a VDOM

The routing you define applies only to network traffic entering non-ssl interfaces belonging to this VDOM. Set the administrative distance high enough, typically 20, so that automatically configured routes will be preferred to the default.

In the following procedure, it is assumed that a VDOM called “Client2” exists. The procedure will create a default static route for this VDOM. The route has a destination IP of 0.0.0.0, on the port3 interface. It has a gateway of 10.10.10.1, and an administrative distance of 20.

The values used in this procedure are very standard, and this procedure should be part of configuring all VDOMs.

To add a default static route for a VDOM - web-based manager:

1. In **Virtual Domains**, select the client2 VDOM.
2. Go to **Router > Static > Static Routes**.
3. Select **Create New**.
4. Enter the following information and select **OK**:

Destination IP/Mask	0.0.0.0/0.0.0.0
Device	port2
Gateway	10.10.10.1
Distance	20

To add a default static route for a VDOM - CLI:

```
config vdom
  edit client2
    config router static
      edit 4
        set device port2
        set dst 0.0.0.0 0.0.0.0
        set gateway 10.10.10.1
        set distance 20
      end
    end
  end
```

Dynamic Routing in VDOMs

Dynamic routing is VDOM-specific, like all other routing. Dynamic routing configuration is the same with VDOMs as with your FortiGate unit without VDOMs enabled, once you are at the routing menu. If you have multiple VDOMs configured, the dynamic routing configuration between them can become quite complex.

VDOMs provide some interesting changes to dynamic routing. Each VDOM can be a neighbor to the other VDOMs. This is useful in simulating a dynamic routing area or AS or network using only your FortiGate unit.

You can separate different types of routing to different VDOMs if required. This allows for easier troubleshooting. This is very useful if your FortiGate unit is on the border of a number of different routing domains.

For more information on dynamic routing in FortiOS, see [Dynamic Routing Overview](#).

Inter-VDOM links must have IP addresses assigned to them if they are part of a dynamic routing configuration. Inter-VDOM links may or may not have IP addresses assigned to them. Without IP addresses, you need to be careful how you configure routing. While the default static route can be assigned an address of 0.0.0.0 and rely instead on the interface, dynamic routing almost always requires an IP address.

RIP

The RIP dynamic routing protocol uses hop count to determine the best route, with a hop count of 1 being directly attached to the interface and a hop count of 16 being unreachable. For example if two VDOMs on the same FortiGate unit are RIP neighbors, they have a hop count of 1.

OSPF

OSPF communicates the status of its network links to adjacent neighbor routers instead of the complete routing table. When compared to RIP, OSPF is more suitable for large networks, it is not limited by hop count, and is more complex to configure. For smaller OSPF configurations its easiest to just use the backbone area, instead of multiple areas.

BGP

BGP is an Internet gateway protocol (IGP) used to connect autonomous systems (ASes) and is used by Internet service providers (ISPs). BGP stores the full path, or path vector, to a destination and its attributes which aid in proper routing.

Configuring security policies for NAT/Route VDOMs

Security policies are VDOM-specific. This means that all firewall settings for a VDOM, such as firewall addresses and security policies, are configured within the VDOM.

In VDOMs, all firewall related objects are configured per-VDOM including addresses, service groups, security profiles, schedules, traffic shaping, and so on. If you want firewall addresses, you will have to create them on each VDOM separately. If you have many addresses, and VDOMs this can be tedious and time consuming. Consider using a FortiManager unit to manage your VDOM configuration — it can get firewall objects from a configured VDOM or FortiGate unit, and push those objects to many other VDOMs or FortiGate units. See the [FortiManager Administration Guide](#).



You can customize the **Policy** display by including some or all columns, and customize the column order onscreen. Due to this feature, security policy screenshots may not appear the same as on your screen.

Configuring a security policy for a VDOM

Your security policies can involve only the interfaces, zones, and firewall addresses that are part of the current VDOM, and they are only visible when you are viewing the current VDOM. The security policies of this VDOM filter the network traffic on the interfaces and VLAN subinterfaces in this VDOM.

A firewall service group can be configured to group multiple services into one service group. When a descriptive name is used, service groups make it easier for an administrator to quickly determine what services are allowed by a security policy.

In the following procedure, it is assumed that a VDOM called `Client2` exists. The procedure will configure an outgoing security policy. The security policy will allow all HTTPS and SSH traffic for the `SalesLocal` address group on `VLAN_200` going to all addresses on `port3`. This traffic will be scanned and logged.

To configure a security policy for a VDOM - web-based manager:

1. In **Virtual Domains**, select the `client2` VDOM.
2. Go to **Policy > Policy**.
3. Select **Create New**.
4. Enter the following information and select **OK**:

Source Interface/Zone	VLAN_200
Source Address	SalesLocal
Destination Interface/Zone	port3
Destination Address	any
Schedule	always
Service	Multiple - HTTPS, SSH
Action	ACCEPT
Log Allowed Traffic	enable

To configure a security policy for a VDOM - CLI:

```
config vdom
  edit Client2
    config firewall policy
      edit 12
        set srcintf VLAN_200
        set srcaddr SalesLocal
        set dstintf port3(dmz)
        set dstaddr any
        set schedule always
        set service HTTPS SSH
        set action accept
        set status enable
        set logtraffic enable
      end
    end
  end
```

Configuring security profiles for NAT/Route VDOMs

In NAT/Route VDOMs, security profiles are exactly like regular FortiGate unit operation with one exception. In VDOMs, there are no default security profiles.

If you want security profiles in VDOMs, you must create them yourself. If you have many security profiles to create in each VDOM, you should consider using a FortiManager unit. It can get existing profiles from a VDOM or FortiGate unit, and push those profiles down to multiple other VDOMs or FortiGate units. See the [FortiManager Administration Guide](#).

When VDOMs are enabled, you only need one FortiGuard license for the physical unit, and download FortiGuard updates once for the physical unit. This can result in a large time and money savings over multiple physical units if you have many VDOMs.

Configuring VPNs for a VDOM

Virtual Private Networking (VPN) settings are VDOM-specific, and must be configured within each VDOM. Configurations for IPsec Tunnel, IPsec Interface, PPTP and SSL are VDOM-specific. However, certificates are shared by all VDOMs and are added and configured globally to the FortiGate unit.

Example NAT/Route VDOM configuration

Company A and Company B each have their own internal networks and their own ISPs. They share a FortiGate unit that is configured with two separate VDOMs, with each VDOM running in NAT/Route mode enabling separate configuration of network protection profiles. Each ISP is connected to a different interface on the FortiGate unit.

This network example was chosen to illustrate one of the most typical VDOM configurations.

This example has the following sections:

- [Network topology and assumptions](#)
- [General configuration steps](#)
- [Creating the VDOMs](#)
- [Configuring the FortiGate interfaces](#)
- [Configuring the vdomA VDOM](#)
- [Configuring the vdomB VDOM](#)
- [Testing the configuration](#)

Network topology and assumptions

Both companies have their own ISPs and their own internal interface, external interface, and VDOM on the FortiGate unit.

For easier configuration, the following IP addressing is used:

- all IP addresses on the FortiGate unit end in “.2” such as 10.11.101.2.
- all IP addresses for ISPs end in “.7”, such as 172.20.201.7.
- all internal networks are 10.*.* networks, and sample internal addresses end in “.55”.

The IP address matrix for this example is as follows.

Address	Company A	Company B
ISP	172.20.201.7	192.168.201.7
Internal network	10.11.101.0	10.12.101.0

Address	Company A	Company B
FortiGate / VDOM	172.20.101.2 (port1)	192.168.201.2 (port3)
	10.11.101.2 (port4)	10.12.101.2 (port2)

The Company A internal network is on the 10.11.101.0/255.255.255.0 subnet. The Company B internal network is on the 10.12.101.0/255.255.255.0 subnet.

There are no switches or routers required for this configuration.

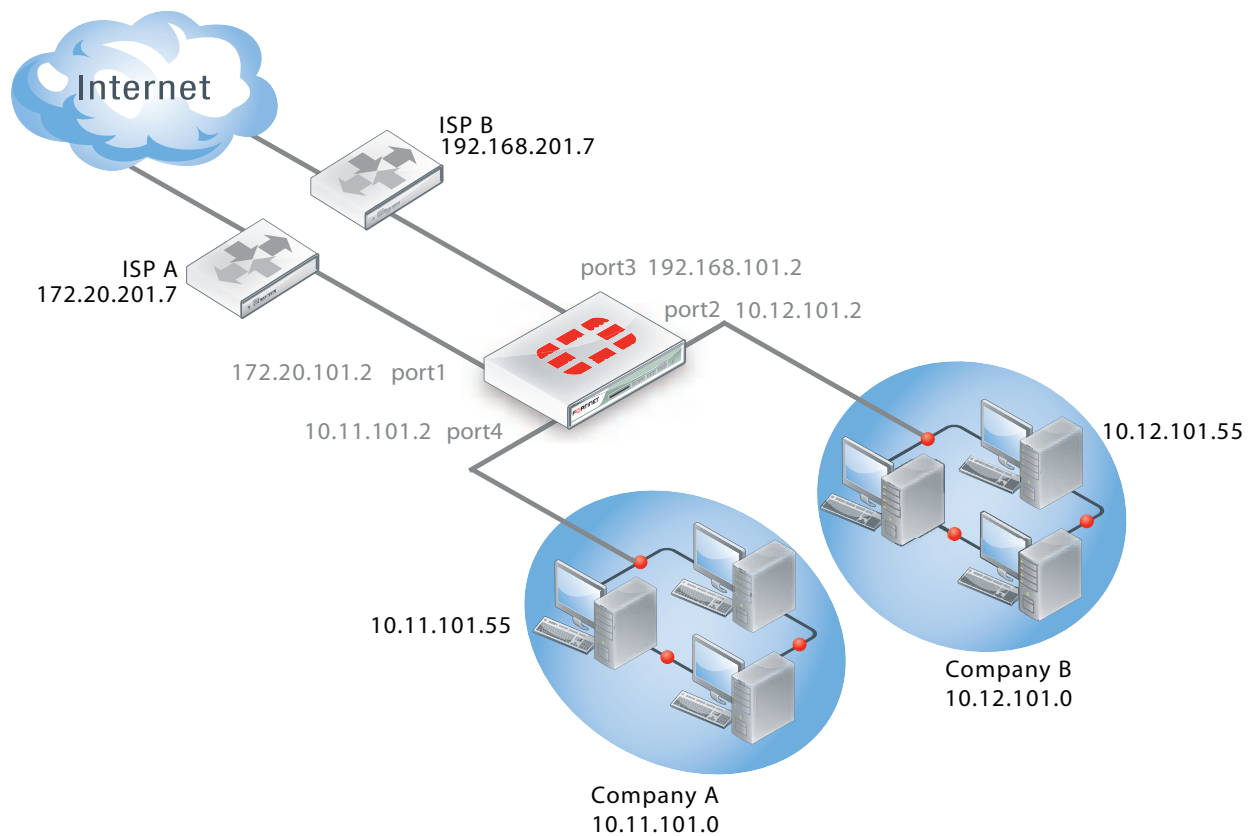
There are no VLANs in this network topology.

The interfaces used in this example are port1 through port4. Different FortiGate models may have different interface labels. port1 and port3 are used as external interfaces. port2 and port4 are internal interfaces.

The administrator is a super_admin account. If you are using a non-super_admin account, refer to "Global and per-VDOM settings" to see which parts a non-super_admin account can also configure.

When configuring security policies in the CLI always choose a policy number that is higher than any existing policy numbers, select `services` before `profile-status`, and `profile-status` before `profile`. If these commands are not entered in that order, they may not be available to enter.

Figure 9: Example VDOM configuration



General configuration steps

For best results in this configuration, follow the procedures in the order given. Also, note that if you perform any additional actions between procedures, your configuration may have different results.

1. [Creating the VDOMs](#)
2. [Configuring the FortiGate interfaces](#)
3. [Configuring the vdomA VDOM](#), and [Configuring the vdomB VDOM](#)
4. [Testing the configuration](#)

Creating the VDOMs

In this example, two new VDOMs are created — vdomA for Company A and vdomB for Company B. These VDOMs will keep the traffic for these two companies separate while enabling each company to access its own ISP.

To create two VDOMs - web-based manager:

1. Log in with a super_admin account.
2. Go to **Global > VDOM > VDOM**, and select **Create New**.
3. Enter vdomA and select **OK**.
4. Select **OK** again to return to the VDOM list.
5. Select **Create New**.
6. Enter vdomB and select **OK**.

To create two VDOMs - CLI:

```
config vdom
  edit vdomA
  next
  edit vdomB
end
```

Configuring the FortiGate interfaces

This section configures the interfaces that connect to the companies' internal networks, and to the companies' ISPs.

All interfaces on the FortiGate unit will be configured with an IP address ending in ".2" such as 10.11.101.2. This will simplify network administration both for the companies, and for the FortiGate unit global administrator. Also the internal addresses for each company differ in the second octet of their IP address - Company A is 10.11.*, and Company B is 10.12.*.

This section includes the following topics:

- [Configuring the vdomA interfaces](#)
- [Configuring the vdomB interfaces](#)



If you cannot change the VDOM of a network interface it is because something is referring to that interface that needs to be deleted. Once all the references are deleted the interface will be available to switch to a different VDOM. For example a common reference to the external interface is the default static route entry. See [Configuring interfaces in a NAT/Route VDOM](#).

Configuring the vdomA interfaces

The vdomA VDOM includes two FortiGate unit interfaces: port1 and external.

The port4 interface connects the Company A internal network to the FortiGate unit, and shares the internal network subnet of 10.11.101.0/255.255.255.0.

The external interface connects the FortiGate unit to ISP A and the Internet. It shares the ISP A subnet of 172.20.201.0/255.255.255.0.

To configure the vdomA interfaces - web-based manager:

1. Go to **Global > Network > Interfaces**.
2. Select **Edit** on the port1 interface.
3. Enter the following information and select **OK**:

Virtual Domain	vdomA
Addressing mode	Manual
IP/Netmask	172.20.101.2/255.255.255.0

4. Select **Edit** on the port4 interface.
5. Enter the following information and select **OK**:

Virtual Domain	vdomA
Addressing mode	Manual
IP/Netmask	10.11.101.2/255.255.255.0

To configure the vdomA interfaces - CLI:

```
config global
  config system interface
    edit port1
      set vdom vdomA
      set mode static
      set ip 172.20.101.2 255.255.255.0
    next
    edit port4
      set vdom vdomA
      set mode static
      set ip 10.11.101.2 255.255.255.0
    end
  end
```

Configuring the vdomB interfaces

The vdomB VDOM uses two FortiGate unit interfaces: port2 and port3.

The port2 interface connects the Company B internal network to the FortiGate unit, and shares the internal network subnet of 10.12.101.0/255.255.255.0.

The port3 interface connects the FortiGate unit to ISP B and the Internet. It shares the ISP B subnet of 192.168.201.0/255.255.255.0.

To configure the vdomB interfaces - web-based manager:

1. Go to **Global > Network > Interfaces**.
2. Select **Edit** on the port3 interface.
3. Enter the following information and select **OK**:

Virtual domain	vdomB
Addressing mode	Manual
IP/Netmask	192.168.201.2/255.255.255.0

4. Select **Edit** on the port2 interface.
5. Enter the following information and select **OK**:

Virtual domain	vdomB
Addressing mode	Manual
IP/Netmask	10.12.101.2/255.255.255.0

To configure the vdomB interfaces - CLI:

```
config global
  config system interface
    edit port3
      set vdom vdomB
      set mode static
      set ip 192.168.201.2 255.255.255.0
    next
    edit port2
      set vdom vdomB
      set mode static
      set ip 10.12.101.2 255.255.255.0
    end
  end
```

Configuring the vdomA VDOM

With the VDOMs created and the ISPs connected, the next step is to configure the vdomA VDOM.

Configuring the vdomA includes the following:

- [Adding vdomA firewall addresses](#)
- [Adding the vdomA security policy](#)
- [Adding the vdomA default route](#)

Adding vdomA firewall addresses

You need to define the addresses used by Company A's internal network for use in security policies. This internal network is the 10.11.101.0/255.255.255.0 subnet.

The FortiGate unit provides one default address, "all", that you can use when a security policy applies to all addresses as the source or destination of a packet.

To add the vdomA firewall addresses - web-based manager:

1. In **Virtual Domains**, select **vdomA**.
2. Go to **Firewall Objects > Address > Address**.
3. Select **Create New**.
4. Enter the following information and select **OK**:

Address Name	Ainternal
Type	Subnet / IP Range
Subnet / IP Range	10.11.101.0/255.255.255.0
Interface	port4

To add the vdomA VDOM firewall addresses - CLI:

```
config vdom
  edit vdomA
    config firewall address
      edit Ainternal
        set type ipmask
        set subnet 10.11.101.0 255.255.255.0
      end
    end
  end
```

Adding the vdomA security policy

You need to add the vdomA security policy to allow traffic from the internal network to reach the external network, and from the external network to internal as well. You need two policies for this domain.

To add the vdomA security policy - web-based manager:

1. In **Virtual Domains**, select **vdomA**.
2. Go to **Policy > Policy**.
3. Select **Create New**.
4. Enter the following information and select **OK**:

Source Interface/Zone	port4
------------------------------	-------

Source Address	Ainternal
Destination Interface/Zone	port1
Destination Address	all
Schedule	Always
Service	ANY
Action	ACCEPT

5. Select **Create New**.
6. Enter the following information and select **OK**:

Source Interface/Zone	port1
Source Address	all
Destination Interface/Zone	port4
Destination Address	Ainternal
Schedule	Always
Service	ANY
Action	ACCEPT

To add the vdomA security policy - CLI:

```

config vdom
  edit vdomA
    config firewall policy
      edit 1
        set srcintf port4
        set srcaddr Ainternal
        set dstintf port1
        set dstaddr all
        set schedule always
        set service ANY
        set action accept
        set status enable
      next
      edit 2
        set srcintf port1
        set srcaddr all
        set dstintf port4
        set dstaddr Ainternal
        set schedule always
        set service ANY
        set action accept
        set status enable
      end
    end
  end

```

Adding the vdomA default route

You also need to define a default route to direct packets from the Company A internal network to ISP A. Every VDOM needs a default static route, as a minimum, to handle traffic addressed to external networks such as the Internet.

The administrative distance should be set slightly higher than other routes. Lower admin distances will get checked first, and this default route will only be used as a last resort.

To add a default route to the vdomA - web-based manager:

1. For **Virtual Domains**, select **vdomA**
2. Go to **Router > Static > Static Routes**.
3. Select **Create New**.
4. Enter the following information and select **OK**:

Destination IP/Mask	0.0.0.0/0.0.0.0
Device	port1
Gateway	172.20.201.7
Distance	20

To add a default route to the vdomA - CLI:

```
config vdom
  edit vdomA
    config router static
      edit 1
        set device port1
        set gateway 172.20.201.7
      end
```

Configuring the vdomB VDOM

In this example, the vdomB VDOM is used for Company B. Firewall and routing settings are specific to a single VDOM.

vdomB includes the FortiGate port2 interface to connect to the Company B internal network, and the FortiGate port3 interface to connect to ISP B. Security policies are needed to allow traffic from port2 to external and from external to port2 interfaces.

This section includes the following topics:

- [Adding the vdomB firewall address](#)
- [Adding the vdomB security policy](#)
- [Adding a default route to the vdomB VDOM](#)

Adding the vdomB firewall address

You need to define addresses for use in security policies. In this example, the vdomB VDOM needs an address for the port2 interface and the “all” address.

To add the vdomB firewall address - web-based manager:

1. In **Virtual Domains**, select **vdomB**.
2. Go to **Firewall Objects > Address > Address**.
3. Select **Create New**.
4. Enter the following information and select **OK**:

Address Name	Binternal
Type	Subnet / IP Range
Subnet / IP Range	10.12.101.0/255.255.255.0
Interface	port2

To add the vdomB firewall address - CLI:

```
config vdom
  edit vdomB
    config firewall address
      edit Binternal
        set type ipmask
        set subnet 10.12.101.0 255.255.255.0
      end
    end
  end
```

Adding the vdomB security policy

You also need a security policy for the Company B domain. In this example, the security policy allows all traffic.

To add the vdomB security policy - web-based manager:

1. Log in with a super_admin account.
2. In **Virtual Domains**, select vdomB.
3. Go to **Policy > Policy**.
4. Select **Create New**.
5. Enter the following information and select **OK**:

Source Interface/Zone	port2
Source Address	Binternal
Destination Interface/Zone	port3
Destination Address	all

Schedule	Always
Service	ANY
Action	ACCEPT

6. Select **Create New**.
7. Enter the following information and select **OK**:

Source Interface/Zone	port3
Source Address	all
Destination Interface/Zone	port2
Destination Address	Binternal
Schedule	Always
Service	ANY
Action	ACCEPT

To add the vdomB security policy - CLI:

```
config vdom
  edit vdomB
    config firewall policy
      edit 1
        set srcintf port2
        set dstintf port3
        set srcaddr Binternal
        set dstaddr all
        set schedule always
        set service ANY
        set action accept
        set status enable
      edit 1
        set srcintf port3
        set dstintf port2
        set srcaddr all
        set dstaddr Binternal
        set schedule always
        set service ANY
        set action accept
        set status enable
      end
    end
  end
```

Adding a default route to the vdomB VDOM

You need to define a default route to direct packets to ISP B.

To add a default route to the vdomB VDOM - web-based manager:

1. Log in as the super_admin administrator.
2. In **Virtual Domains**, select vdomB.
3. Go to **Router > Static > Static Routes**.
4. Select **Create New**.
5. Enter the following information and select **OK**:

Destination IP/Mask	0.0.0.0/0.0.0.0
Device	port3
Gateway	192.168.201.7
Distance	20

To add a default route to the vdomB VDOM - CLI:

```
config vdom
  edit vdomB
    config router static
      edit 1
        set dst 0.0.0.0/0
        set device external
        set gateway 192.168.201.7
      end
    end
  end
```

Testing the configuration

Once you have completed configuration for both company VDOMs, you can use diagnostic commands, such as `tracert` in Windows, to test traffic routed through the FortiGate unit. Alternately, you can use the `tracert` command on a Linux system with similar output.

Possible errors during the traceroute test are:

- “* * * Request timed out” - the trace was not able to make the next connection towards the destination fast enough
- “Destination host unreachable” - after a number of timed-out responses the trace will give up

Possible reasons for these errors are bad connections or configuration errors.

For additional troubleshooting, see [Troubleshooting Virtual Domains](#).

Testing traffic from the internal network to the ISP

In this example, a route is traced from the Company A internal network to ISP A. The test was run on a Windows PC with an IP address of 10.11.101.55.

The output here indicates three hops between the source and destination, the IP address of each hop, and that the trace was successful.

From the Company A internal network, access a command prompt and enter this command:

```
C:\>tracert 172.20.201.7
Tracing route to 172.20.201.7 over a maximum of 30 hops:
  1  <10 ms  <10 ms  <10 ms  10.11.101.2
  2  <10 ms  <10 ms  <10 ms  172.20.101.2
  3  <10 ms  <10 ms  <10 ms  172.20.201.7
Trace complete.
```

Virtual Domains in Transparent mode

In Transparent mode, the FortiGate unit behaves like a layer-2 bridge but can still provide services such as antivirus scanning, web filtering, spam filtering and intrusion protection to traffic. There are some limitations in Transparent mode in that you cannot use SSL VPN, PPTP/L2TP VPN, DHCP server, or easily perform NAT on traffic. The limits in Transparent mode apply to IEEE 802.1Q VLAN trunks passing through the unit.

VDOMs can each be configured to operate either in Transparent or NAT/Route operation mode, with each VDOM behaving like a separate FortiGate unit operating in the respective mode. VLANs configured on a VDOM in Transparent mode are the same as VLANs configured on the FortiGate unit when VDOMs are disabled.

This chapter includes the following sections:

- [Transparent operation mode](#)
- [Configuring VDOMs in Transparent mode](#)
- [Example of VDOMs in Transparent mode](#)

Transparent operation mode

In transparent mode, the FortiGate unit becomes a layer-2 IP forwarding bridge. This means that Ethernet frames are forwarded based on destination MAC address, and no other routing is performed. All incoming traffic that is accepted by the firewall, is broadcast out on all interfaces.

In transparent mode the FortiGate unit is a forwarding bridge, not a switch. A switch can develop a port table and associated MAC addresses, so that it can bridge two ports to deliver the traffic instead of broadcasting to all ports. In transparent mode, the FortiGate unit does not follow this switch behavior, but instead is the forwarding bridge that broadcasts all packets out over all interfaces, subject to security policies.

Features such as broadcast domains, forwarding domains, and STP apply to both FortiGate units and VDOMs in Transparent mode.

Broadcast domains

A broadcast domain is a network segment in which any network equipment can transmit data directly to another device without going through a routing device. All the devices share the same subnet. The subnets are separated by layer-3 devices, such as routers, that can forward traffic from one broadcast domain to the next.

Broadcast domains are important to transparent mode FortiGate units because the broadcast domain is the limit of where the FortiGate unit can forward packets when it is in transparent mode.

Forwarding domains

Address Resolution Protocol (ARP) packets are vital to communication on a network, and ARP support is enabled on FortiGate unit interfaces by default. Normally you want ARP packets to pass through the FortiGate unit. However, in Transparent mode ARP packets arriving on one interface are sent to all other interfaces including VLANs giving the appearance of duplicates of the same MAC address on different interfaces. Some layer-2

switches become unstable when they detect these duplicate MAC addresses. Unstable switches may become unreliable or reset and cause network traffic to slow down considerably.

When you are using VLANs in Transparent mode, the solution to the duplicate MAC address issue is to use the `forward-domain` CLI command. This command tags VLAN traffic as belonging to a particular collision group, and only VLANs tagged as part of that collision group receive that traffic—it is like an additional set of VLANs. By default, all interfaces and VLANs are part of forward-domain collision group 0.

To assign VLAN 200 to collision group 2, VLAN 300 to collision group 3, and all other interfaces to stay in the default collision group 0 enter the following CLI commands:

```
config system interface
  edit vlan200
    set vlanid 200
    set forward_domain 2
  next
  edit vlan300
    set vlanid 300
    set forward_domain 3
  next
end
```

When using forwarding domains, you may experience connection issues with layer-2 traffic, such as ping, if your network configuration has

- packets going through the FortiGate unit in Transparent mode multiple times,
- more than one forwarding domain (such as incoming on one forwarding domain and outgoing on another)
- IPS and AV enabled.

Spanning Tree Protocol

VDOMs and FortiGate units do not participate in the Spanning Tree Protocol (STP). STP is an IEEE 802.1 protocol that ensures there are no layer-2 loops on the network. Loops are created when there is more than one route for traffic to take and that traffic is broadcast back to the original switch. This loop floods the network with traffic, quickly reducing available bandwidth to zero.

If you use your VDOM or FortiGate unit in a network topology that relies on STP for network loop protection, you need to make changes to your FortiGate configuration. Otherwise, STP recognizes your FortiGate unit as a blocked link and forwards the data to another path. By default, your FortiGate unit blocks STP as well as other non-IP protocol traffic. Using the CLI, you can enable forwarding of STP and other layer-2 protocols through the interface. In this example, layer-2 forwarding is enabled on the port2 interface:

```
config global
  config system interface
    edit port2
      set l2forward enable
      set stpforward enable
    next
  end
```

There are different CLI commands to allow other common layer-2 protocols such as IPX, PPTP or L2TP on the network. For more information, see the [FortiOS CLI Reference](#).

Differences between NAT/Route and Transparent mode

The differences between NAT/Route mode and Transparent mode include:

Differences between NAT/Route and Transparent modes

Features	NAT/Route mode	Transparent mode
Specific Management IP address required	No	Yes
Perform Network Address Translation (NAT)	Yes	Yes
Stateful packet inspection	Yes	Yes
Layer-2 forwarding	Yes	Yes
Layer-3 routing	Yes	No
Unicast Routing / Policy Based routing	Yes	No
DHCP server	Yes	No
IPsec VPN	Yes	Yes
PPTP/L2TP VPN	Yes	No
SSL VPN	Yes	No
Security features	Yes	Yes
VLAN support	Yes	Yes - limited to VLAN trunks.
Ping servers (dead gateway detection)	Yes	No

To provide administrative access to a FortiGate unit or VDOM in Transparent mode, you must define a management IP address and a gateway. This step is not required in NAT/Route mode where you can access the FortiGate unit through the assigned IP address of any interface where administrative access is permitted.

If you incorrectly set the Transparent mode management IP address for your FortiGate unit, you will be unable to access your unit through the web-based manager. In this situation, you will need to connect to the FortiGate unit using the console cable and change the settings so you can access the unit. Alternately, if your unit has an LCD panel, you can change the operation mode and interface information through the LCD panel.

Operation mode differences in VDOMs

A VDOM, such as root, can have a maximum of 255 interfaces in Network Address Translation (NAT) mode or Transparent mode. This includes VLANs, other virtual interfaces, and physical interfaces. To have more than a total of 255 interfaces configured, you need multiple VDOMs with multiple interfaces on each.

In Transparent mode without VDOMs enabled, all interfaces on the FortiGate unit act as a bridge — all traffic coming in on one interface is sent back out on all the other interfaces. This effectively turns the FortiGate unit into a two interface unit no matter how many physical interfaces it has. When VDOMs are enabled, this allows you to determine how many interfaces to assign to a VDOM running in Transparent mode. If there are reasons for assigning more than two interfaces based on your network topology, you are able to. However, the benefit of VDOMs in this case is that you have the functionality of Transparent mode, but you can use interfaces for NAT/Route traffic as well.

You can add more VDOMs to separate groups of VLAN subinterfaces. When using a FortiGate unit to serve multiple organizations, this configuration simplifies administration because you see only the security policies and settings for the VDOM you are configuring. For information on adding and configuring virtual domains, see [Benefits of Virtual Domains](#).

One essential application of VDOMs is to prevent problems caused when a FortiGate unit is connected to a layer-2 switch that has a global MAC table. FortiGate units normally forward ARP requests to all interfaces, including VLAN subinterfaces. It is then possible for the switch to receive duplicate ARP packets on different VLANs. Some layer-2 switches reset when this happens. As ARP requests are only forwarded to interfaces in the same VDOM, you can solve this problem by creating a VDOM for each VLAN. For a configuration example, see [Example of VDOMs in Transparent mode](#).

Configuring VDOMs in Transparent mode

In Transparent mode, your FortiGate unit becomes a layer-2 bridge — any traffic coming in on one port is broadcast out on all the other ports. If your FortiGate unit has many interfaces, this is not the best use of those interfaces. VDOMs can limit Transparent mode to only a few interfaces while allowing the rest of the FortiGate unit to remain in NAT/Route mode.

The essential steps to configure your FortiGate unit to work with VLANs in Transparent mode are:

- [Switching to Transparent mode](#)
- [Adding VLAN subinterfaces](#)
- [Creating security policies](#)

You can also configure the security profiles that manage antivirus scanning, web filtering and spam filtering.

In Transparent mode, you can access the FortiGate web-based manager by connecting to an interface configured for administrative access and using HTTPS to access the management IP address. On the FortiGate unit used for examples in this guide, administrative access is enabled by default on the internal interface and the default management IP address is 10.11.0.1.

Switching to Transparent mode

A VDOM is in NAT/Route mode by default when it is created. You must switch it to Transparent mode, and add a management IP address so you can access the VDOM from your management computer.



Before applying the change to Transparent mode, ensure the VDOM has administrative access on the selected interface, and that the selected management IP address is reachable on your network.

To switch the `tpVDOM` VDOM to Transparent mode - web-based manager:

1. Go to **Global > VDOM > VDOM**.
2. Edit the `tpVDOM`.
3. Select `Transparent` for **Operation mode**.
4. Enter the management IP/Netmask.
The IP address must be accessible to the subnet where the management computer is located. For example 10.11.0.99/255.255.255.0 will be able to access the 10.11.0.0 subnet.
5. Select **Apply**.

When you select **Apply**, the FortiGate unit will log you out. When you log back in, the VDOM will be in Transparent mode.

To switch the `tpVDOM` VDOM to Transparent mode - CLI:

```
config vdom
  edit tpVDOM
    config system settings
      set opmode transparent
      set mangeip 10.11.0.99 255.255.255.0
    end
  end
```

Adding VLAN subinterfaces

There are a few differences when adding VLANs in Transparent mode compared to NAT/Route mode.

In Transparent mode, VLAN traffic is trunked across the VDOM. That means VLAN traffic cannot be routed, changed, or inspected. For this reason when you assign a VLAN to a Transparent mode VDOM, you will see the **Addressing Mode** section of the interface configuration disappear in from the web-based manager. It is because with no routing, inspection, or any activities able to be performed on VLAN traffic the VDOM simply re-broadcasts the VLAN traffic. This requires no addressing.

Also any routing related features such as dynamic routing or Virtual Router Redundancy Protocol (VRRP) are not available in Transparent mode for any interfaces.

Creating security policies

Security policies permit communication between the FortiGate unit's network interfaces based on source and destination IP addresses. Typically you will also limit communication to desired times and services for additional

security.

In Transparent mode, the FortiGate unit performs antivirus and antispam scanning on each packet as it passes through the unit. You need security policies to permit packets to pass from the VLAN interface where they enter the unit to the VLAN interface where they exit the unit. If there are no security policies configured, no packets will be allowed to pass from one interface to another. For more information, see the [FortiGate Administration Guide](#).

Example of VDOMs in Transparent mode

In this example, the FortiGate unit provides network protection to two organizations — Company A and Company B. Each company has different policies for incoming and outgoing traffic, requiring three different security policies and protection profiles.

VDOMs are not required for this configuration, but by using VDOMs the profiles and policies can be more easily managed on a per-VDOM basis either by one central administrator or separate administrators for each company. Also future expansion is simply a matter of adding additional VDOMs, whilst not disrupt the existing VDOMs.

For this example, firewalls are only included to deal with web traffic. This is to provide an example without making configuration unnecessarily complicated.

This example includes the following sections:

- [Network topology and assumptions](#)
- [General configuration steps](#)
- [Configuring common items](#)
- [Creating virtual domains](#)
- [Configuring the Company_A VDOM](#)
- [Configuring the Company_B VDOM](#)
- [Virtual Domains in Transparent mode](#)
- [Testing the configuration](#)

Network topology and assumptions

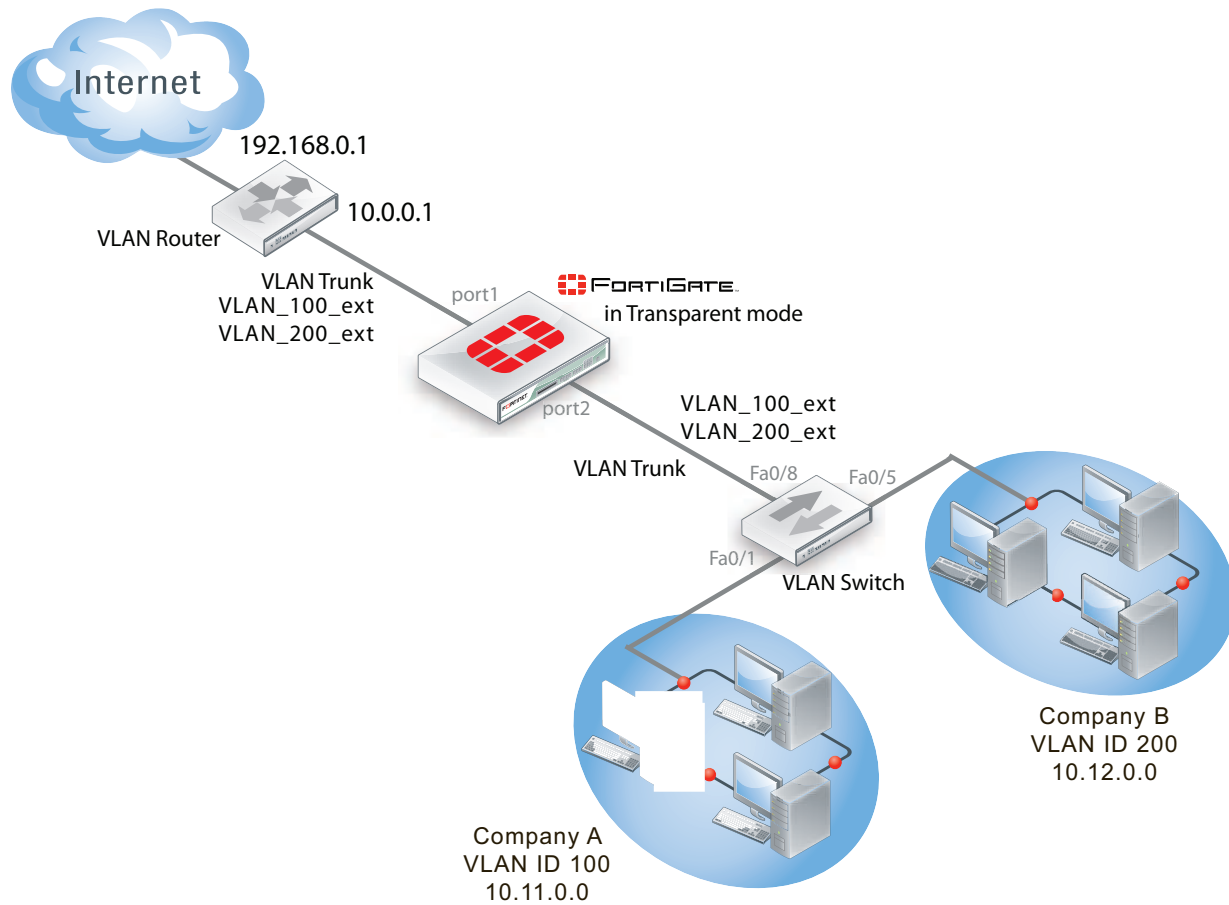
Each organization's internal network consists of a different range of IP addresses:

- 10.11.0.0/255.255.0.0 for Company A.
- 10.12.0.0/255.255.0.0 for Company B.

For the procedures in this section, it is assumed that you have enabled VDOM configuration on your FortiGate unit. For more information, see [Enabling and accessing Virtual Domains](#).

The VDOM names are similar to the company names for easy recognition. The root VDOM cannot be renamed and is not used in this example.

Interfaces used in this example are port1 and port2. Some FortiGate models may not have interfaces with these names. port1 is an external interface. port2 is an internal interface.

Figure 10: VLAN and VDOM Transparent example network topology

General configuration steps

The following steps summarize the configuration for this example. For best results, follow the procedures in the order given. Also, note that if you perform any additional actions between procedures, your configuration may have different results.

1. [Configuring common items](#)
2. [Creating virtual domains](#)
3. [Configuring the Company_A VDOM](#)
4. [Configuring the Company_B VDOM](#)
5. [Virtual Domains in Transparent mode](#)
6. [Testing the configuration](#)

Configuring common items

Both VDOMs require you configure security profiles. These will be configured the same way, but need to be configured in both VDOMs.

The relaxed profile allows users to surf websites they are not allowed to visit during normal business hours. Also a quota is in place to restrict users to one hour of access to these websites to ensure employees do not take long and unproductive lunches.

To create a strict web filtering profile - web-based manager:

1. Go to the proper VDOM, and select **Security Profiles > Web Filter > Profile**.
2. Select **Create New**.
3. Enter `strict` for the **Name**.
4. Expand FortiGuard Web Filtering, and select block for all Categories except Business Oriented, and Other.
5. Block all Classifications except Cached Content, and Image Search.
6. Ensure **FortiGuard Quota** for all Categories and Classifications is Disabled.
7. Select **OK**.

To create a strict web filtering profile - CLI:

```
config vdom
  edit <vdom_name>
    config webfilter profile
      edit strict
        config ftgd-wf
          set allow g07 g08 g21 g22 c01 c03
          set deny g01 g02 g03 g04 g05 g06 c02 c04 c05 c06 c07
        end
        set web-ftgd-err-log enable
      end
    end
  end
```

To create a relaxed web filtering profile - web-based manager:

1. Go to the proper VDOM, and select **Security Profiles > Web Filter > Profile**.
2. Select **Create New**.
3. Enter `relaxed` for the **Name**.
4. Expand FortiGuard Web Filtering, and select block for Potentially Security Violating Category, and Spam URL Classification.
5. Enable FortiGuard Quotas to allow 1 hour for all allowed Categories and Classifications.

Creating virtual domains

The FortiGate unit supports 10 virtual domains. Root is the default VDOM. It cannot be deleted or renamed. The root VDOM is not used in this example. New VDOMs are created for Company A and Company B

To create the virtual domains - web-based manager:

1. With VDOMs enabled, select **System > VDOM > VDOM**.
2. Select **Create New**.
3. Enter `Company_A` for Name, and select **OK**.
4. Select **Create New**.
5. Enter `Company_B` for Name, and select **OK**.

To create the virtual domains - CLI:

```
config system vdom
  edit Company_A
  next
  edit Company_B
end
```

Configuring the Company_A VDOM

This section describes how to add VLAN subinterfaces and configure security policies for the Company_A VDOM.

This section includes the following topics:

- [Adding VLAN subinterfaces](#)
- [Creating the Lunch schedule](#)
- [Configuring Company_A firewall addresses](#)
- [Creating Company_A security policies](#)

Adding VLAN subinterfaces

You need to create a VLAN subinterface on the port2 interface and another one on the port1 interface, both with the same VLAN ID.

To add VLAN subinterfaces - web-based manager:

1. Go to **System > Network > Interfaces**.
2. Select **Create New**.
3. Enter the following information and select **OK**:

Name	VLAN_100_int
Interface	port2
VLAN ID	100
Virtual Domain	Company_A

4. Select **Create New**.
5. Enter the following information and select **OK**:

Name	VLAN_100_ext
Interface	port1
VLAN ID	100
Virtual Domain	Company_A

To add the VLAN subinterfaces - CLI:

```
config system interface
```

```
edit VLAN_100_int
  set interface port2
  set vlanid 100
  set vdom Company_A
next
edit VLAN_100_ext
  set interface port1
  set vlanid 100
  set vdom Company_A
end
```

Creating the Lunch schedule

Both organizations have the same lunch schedule, but only Company A has relaxed its security policy to allow employees more freedom in accessing the Internet during lunch. Lunch schedule will be Monday to Friday from 11:45am to 2:00pm (14:00).

To create a recurring schedule for lunchtime - web-based manager:

1. In Company_A VDOM, go to **Firewall Objects > Schedule > Recurring**.
2. Select **Create New**.
3. Enter **Lunch** as the name for the schedule.
4. Select **Mon, Tues, Wed, Thu, and Fri**.
5. Set the **Start** time as **11:45** and set the **Stop** time as **14:00**.
6. Select **OK**.

To create a recurring schedule for lunchtime - CLI:

```
config vdom
  edit Company_A
    config firewall schedule recurring
      edit Lunch
        set day monday tuesday wednesday thursday friday
        set start 11:45
        set end 14:00
      end
    end
```

Configuring Company_A firewall addresses

For Company A, its networks are all on the 10.11.0.0 network, so restricting addresses to that domain provides added security.

To configure Company_A firewall addresses - web-based manager:

1. In the Company_A VDOM, go to **Firewall Objects > Address > Address**.
2. Select **Create New**.
3. Enter **CompanyA** in the **Address Name** field.
4. Type **10.11.0.0/255.255.0.0** in the **Subnet / IP Range** field.
5. Select **OK**.

To configure vdomA firewall addresses - CLI:

```
config firewall address
```

```

edit CompanyA
  set type ipmask
  set subnet 10.11.0.0 255.255.0.0
end

```

Creating Company_A security policies

A security policy can include varying levels of security feature protection. This example only deals with web filtering. The following security policies use the custom security `strict` and `relaxed` profiles configured earlier. See [Configuring common items](#).

For these security policies, we assume that all protocols will be on their standard ports, such as port 80 for http traffic. If the ports are changed, such as using port 8080 for http traffic, you will have to create custom services for protocols with non-standard ports, and assign them different names.

The firewalls configured in this section are:

- internal to external — always deny all
- external to internal — always deny all
- internal to external — always allow all, security features - web filtering: strict
- internal to external — Lunch allow all, security features - web filtering:relaxed

Security policies allow packets to travel between the internal VLAN_100 interface to the external interface subject to the restrictions of the protection profile. Entering the policies in this order means the last one configured is at the top of the policy list, and will be checked first. This is important because the policies are arranged so if one does not apply the next is checked until the end of the list.

To configure Company_A security policies - web-based manager:

1. Go to **Policy > Policy**.
2. Select **Create New**.
3. Enter the following information and select **OK**:

Source Interface/Zone	VLAN_100_int
Source Address	CompanyA
Destination Interface/Zone	VLAN_100_ext
Destination Address	all
Schedule	always
Service	all
Action	DENY

This policy is a catch all for outgoing traffic to ensure that if it doesn't match any of the other policies, it will not be allowed. This is standard procedure.

4. Select **Create New**.
5. Enter the following information and select **OK**:

Source Interface/Zone	VLAN_100_ext
Source Address	all
Destination Interface/Zone	VLAN_100_int
Destination Address	CompanyA
Schedule	always
Service	all
Action	DENY

This policy is a catch all for incoming traffic to ensure that if it doesn't match any of the other policies, it will not be allowed. This is standard procedure.

6. Select **Create New**.
7. Enter the following information and select **OK**:

Source Interface/Zone	VLAN_100_int
Source Address	CompanyA
Destination Interface/Zone	VLAN_100_ext
Destination Address	all
Schedule	always
Service	all
Action	ACCEPT
Security Features	enable
Web Filtering	strict

This policy enforces strict scanning at all times, while allowing all traffic. It ensures company policies are met for network security.

8. Select **Create New**.
9. Enter the following information and select **OK**:

Source Interface/Zone	VLAN_100_int
Source Address	CompanyA
Destination Interface/Zone	VLAN_100_ext
Destination Address	all
Schedule	Lunch

Service	all
Action	ACCEPT
Security Features	enable
Web Filtering	relaxed

This policy provides relaxed protection during lunch hours — going from strict down to scan for protocol options and web filtering. AntiVirus and Email Filtering remain at strict for security — relaxing them would not provide employees additional access to the Internet and it would make the company vulnerable.

10. Verify that the policies entered appear in the list with the last policy (lunch) at the top, and the first policy (deny all) at the bottom. Otherwise traffic will not flow as expected.

To configure Company_A security policies - CLI:

```
config vdom
  edit Company_A
    config firewall policy
      edit 1
        set srcintf VLAN_100_int
        set dstintf VLAN_100_ext
        set srcaddr all
        set dstaddr all
        set action accept
        set schedule Lunch
        set webfiltering relaxed
      next
      edit 3
        set srcintf VLAN_100_int
        set dstintf VLAN_100_ext
        set srcaddr all
        set dstaddr all
        set action accept
        set schedule BusinessDay
        set service HTTP
        set profile_status enable
        set profile BusinessOnly
      end
    end
  end
```

Configuring the Company_B VDOM

This section describes how to add VLAN subinterfaces and configure security policies for the Company B VDOM.

This section includes the following topics:

- [Adding VLAN subinterfaces](#)
- [Creating Company_B service groups](#)
- [Configuring Company_B firewall addresses](#)
- [Configuring Company_B security policies](#)

Adding VLAN subinterfaces

You need to create a VLAN subinterface on the internal interface and another one on the external interface, both with the same VLAN ID.

To add VLAN subinterfaces - web-based manager:

1. Go to **System > Network > Interfaces**.
2. Select **Create New**.
3. Enter the following information and select **OK**:

Name	VLAN_200_int
Interface	port2
VLAN ID	200
Virtual Domain	Company_B

4. Select **Create New**.
5. Enter the following information and select **OK**:

Name	VLAN_200_ext
Interface	port1
VLAN ID	200
Virtual Domain	Company_B

To add the VLAN subinterfaces - CLI:

```
config system interface
  edit VLAN_200_int
    set interface internal
    set vlanid 200
    set vdom Company_B
  next
  edit VLAN_200_ext
    set interface external
    set vlanid 200
    set vdom Company_B
end
```

Creating Company_B service groups

Company_B does not want its employees to use any online chat software except NetMeeting, which the company uses for net conferencing. To simplify the creation of a security policy for this purpose, you create a service group that contains all of the services you want to restrict. A security policy can manage only one service or one group.

To create a chat service group - web-based manager:

1. Go to **Firewall Objects > Service > Groups**.
2. Select **Create New**.
3. Enter `Chat` in the **Group Name** field.
4. For each of IRC, AOL, SIP-MSNmessenger and TALK, select the service in the **Available Services** list and select the right arrow to add it to the **Members** list.

If a particular service does not appear in the **Available Services** list, see the list in **Firewall Objects > Service > Services**. Some services do not appear by default unless edited.

5. Select **OK**.

To create a games and chat service group - CLI:

```
config firewall service group
edit Chat
set member IRC SIP-MSNmessenger AOL TALK
end
```

Configuring Company_B firewall addresses

Company B's network is all in the 10.12.0.0 network. Security can be improved by only allowing traffic from IP addresses on that network.

To configure Company_B firewall address - web-based manager:

1. In the Company_B VDOM, go to **Firewall Objects > Address > Address**.
2. Select **Create New**.
3. Enter `new` in the **Address Name** field.
4. Type `10.12.0.0/255.255.0.0` in the **Subnet / IP Range** field.
5. Select **OK**.

To configure Company_B firewall addresses - CLI:

```
config vdom
edit Company_B
config firewall address
edit all
set type ipmask
set subnet 10.12.0.0 255.255.0.0
end
```

Configuring Company_B security policies

Security policies allow packets to travel between the internal and external VLAN_200 interfaces subject to the restrictions of the protection profile.

To configure Company_B security policies - web-based manager:

1. Go to **Policy > Policy**.
2. Select **Create New**.

3. Enter the following information and select **OK**:

Source Interface/Zone	VLAN_200_int
Source Address	all
Destination Interface/Zone	VLAN_200_ext
Destination Address	all
Schedule	BusinessDay
Service	games-chat
Action	DENY

This policy prevents the use of network games or chat programs (except NetMeeting) during business hours.

4. Enter the following information and select **OK**:

Source Interface/Zone	VLAN_200_int
Source Address	all
Destination Interface/Zone	VLAN_200_ext
Destination Address	all
Schedule	Lunch
Service	HTTP
Action	ACCEPT
Protection Profile	Relaxed

This policy relaxes the web category filtering during lunch hour.

5. Select **Create New**.

6. Enter the following information and select **OK**:

Source Interface/Zone	VLAN_200_int
Source Address	all
Destination Interface/Zone	VLAN_200_ext
Destination Address	all
Schedule	BusinessDay
Service	HTTP

Action	ACCEPT
Protection Profile	BusinessOnly

This policy provides rather strict web category filtering during business hours.

7. Select **Create New**.
8. Enter the following information and select **OK**:

Source Interface/Zone	VLAN_200_int
Source Address	all
Destination Interface/Zone	VLAN_200_ext
Destination Address	all
Schedule	always
Service	ANY
Action	ACCEPT
Protection Profile	Relaxed

Because it is last in the list, this policy applies to the times and services not covered in preceding policies. This means that outside of regular business hours, the Relaxed protection profile applies to email and web browsing, and online chat and games are permitted. Company B needs this policy because its employees sometimes work overtime. The other companies in this example maintain fixed hours and do not want any after-hours Internet access.

To configure Company_B security policies - CLI:

```
config firewall policy
  edit 1
    set srcintf VLAN_200_int
    set srcaddr all
    set dstintf VLAN_200_ext
    set dstaddr all
    set schedule BusinessDay
    set service Games
    set action deny
  next
  edit 2
    set srcintf VLAN_200_int
    set srcaddr all
    set dstintf VLAN_200_ext
    set dstaddr all
    set action accept
    set schedule Lunch
    set service HTTP
    set profile_status enable
    set profile Relaxed
  next
  edit 3
```

```
set srcintf VLAN_200_int
set srcaddr all
set dstintf VLAN_200_ext
set dstaddr all
set action accept
set schedule BusinessDay
set service HTTP
set profile_status enable
set profile BusinessOnly
next
edit 4
set srcintf VLAN_200_int
set srcaddr all
set dstintf VLAN_200_ext
set dstaddr all
set action accept
set schedule always
set service ANY
set profile_status enable
set profile Relaxed
end
```

Testing the configuration

Use diagnostic commands, such as `tracert`, to test traffic routed through the network.

You should test traffic between the internal VLANs as well as from the internal VLANs to the Internet to ensure connectivity.

For additional troubleshooting, see [Troubleshooting Virtual Domains](#).

This section includes the following topics:

- [Testing traffic from VLAN_100 to the Internet](#)
- [Testing traffic from VLAN_100 to VLAN_200](#)

Testing traffic from VLAN_100 to the Internet

In this example, a route is traced from VLANs to a host on the Internet. The route target is `www.example.com`.

From a host on VLAN_100, access a command prompt and enter this command:

```
C:\>tracert www.example.com
Tracing route to www.example.com [208.77.188.166]
over a maximum of 30 hops:
 1 <10 ms <10 ms <10 ms 10.100.0.1
...
14 172 ms 141 ms 140 ms 208.77.188.166
Trace complete.
```

The number of steps between the first and the last hop, as well as their IP addresses, will vary depending on your location and ISP. However, all successful `tracerts` to `www.example.com` will start and end with these lines.

Repeat the `tracert` for VLAN_200.

The `tracert` for each VLAN will include the gateway for that VLAN as the first step. Otherwise, the `tracert` should be the same for each VLAN.

Testing traffic from VLAN_100 to VLAN_200

In this example, a route is traced between two internal networks. The route target is a host on VLAN_200. The Windows traceroute command `tracert` is used.

From VLAN_100, access a Windows command prompt and enter this command:

```
C:\>tracert 10.12.0.2
Tracing route to 10.12.0.2 over a maximum of 30 hops:
 1 <10 ms <10 ms <10 ms 10.100.0.1
 2 <10 ms <10 ms <10 ms 10.12.0.2
Trace complete.
```

You can repeat this for different routes in the topology. In each case the IP addresses will be the gateway for the starting VLAN, and the end point at the ending VLAN.

Inter-VDOM routing

In the past, virtual domains (VDOMs) were separate from each other—there was no internal communication. Any communication between VDOMs involved traffic leaving on a physical interface belonging to one VDOM and re-entering the FortiGate unit on another physical interface belonging to another VDOM to be inspected by firewall policies in both directions.

Inter-VDOM routing changes this. With VDOM links, VDOMs can communicate internally without using additional physical interfaces.

Inter-VDOM routing is the communication between VDOMs. VDOM links are virtual interfaces that connect VDOMs. A VDOM link contains a pair of interfaces with each one connected to a VDOM, and forming either end of the inter-VDOM connection.

This chapter contains the following sections:

- [Benefits of inter-VDOM routing](#)
- [Getting started with VDOM links](#)
- [Dynamic routing over inter-VDOM links](#)
- [HA virtual clusters and VDOM links](#)
- [Example of inter-VDOM routing](#)

Benefits of inter-VDOM routing

Inter-VDOM routing has a number of advantages over independent VDOM routing. These benefits include:

- [Freed-up physical interfaces](#)
- [More speed than physical interfaces](#)
- [Continued support for secure firewall policies](#)
- [Configuration flexibility](#)

Freed-up physical interfaces

Tying up physical interfaces on the FortiGate unit presents a problem. With a limited number of interfaces available, configuration options for the old style of communication between VDOMs are very limited. VLANs can be an answer to this, but they have some limitations.

For example, the FortiGate-800 has 8 physical ethernet ports. If they are assigned 2 per VDOM (one each for external and internal traffic) there can only be 4 VDOMs at most configured, not the 10 VDOMs the license will allow. Adding even one additional interface per VDOM to be used to communicate between VDOMs leaves only 2 VDOMs for that configuration, since it would require 9 interfaces for 3 VDOMs. Even using one physical interface for both external traffic and inter-VDOM communication would severely lower the available bandwidth for external traffic on that interface.

With the introduction of inter-VDOM routing, traffic can travel between VDOMs internally, freeing up physical interfaces for external traffic. Using the above example we can use the 4 VDOM configuration and all the interfaces will have their full bandwidth.

More speed than physical interfaces

Internal interfaces are faster than physical interfaces. Their speed depends on the FortiGate unit CPU and its load. That means that an inter-VDOM link interface will be faster than a outbound physical interface connected to another inbound physical interface.

Inter-VDOM links are CPU bound, and cannot be part of an accelerated pair of interfaces.

However, while one virtual interface with normal traffic would be considerably faster than on a physical interface, the more traffic and more internal interfaces you configure, the slower they will become until they are slower than the physical interfaces. CPU load can come from other sources such as AV or content scanning. This produces the same effect—internal interfaces such as inter-VDOM links will be slower.

Continued support for secure firewall policies

VDOMs help to separate traffic based on your needs. This is an important step in satisfying regulations that require proof of secure data handling. This is especially important to health, law, accounting, and other businesses that handle sensitive data every day.

By keeping things separate, traffic has to leave the FortiGate unit and re-enter to change VDOMs. This forces traffic to go through the firewall when leaving and enter through another firewall, keeping traffic secure.

With inter-VDOM routing, the need for the physical interfaces is greatly reduced. However, firewall policies still need to be in place for traffic to pass through any interface, physical or virtual, and thus provide the same level of security both internally and externally. Configuration of firewall policies is the same for inter-VDOM links as for any other interface, and your data will continue to have the high level of security.

Configuration flexibility

A typical VDOM uses at least two interfaces, typically physical interfaces, one for internal and one for external traffic. Depending on the configuration, more interfaces may be required. This means that the maximum number of VDOMs configurable on a FortiGate unit using physical interfaces is the number of interfaces available divided by two. VLANs can increase the number by providing multiple virtual interfaces over a single physical interface, but VLANs have some limitations. Using physical interfaces for inter-VDOM communication therefore limits the number of possible configurations on your FortiGate unit.

To overcome this limitation, inter-VDOM links can be created within the FortiGate unit. Using virtual interfaces, inter-VDOM links free up the physical interfaces for external traffic. Using VDOM links on a FortiGate unit with 8 physical interfaces, you can have 4 VDOMs communicating with each other (meshed configuration) and continue to have 2 physical interfaces each for internal and external connections. This configuration would have required 20 physical interfaces without inter-VDOM routing. With inter-VDOM routing it only requires 8 physical interfaces, with the other 12 interfaces being internal VDOM links.

Inter-VDOM routing allows you to make use of [Standalone VDOM configuration](#), [Management VDOM configuration](#), and [Meshed VDOM configuration](#) without being limited by the number of physical interfaces on your FortiGate unit.

Getting started with VDOM links

Once VDOMs are configured on your FortiGate unit, configuring inter-VDOM routing and VDOM-links is very much like creating a VLAN interface. VDOM-links are managed through the web-based manager or CLI. In the web-based manager, VDOM link interfaces are managed in the network interface list.

This section includes the following topics:

- Viewing VDOM links
- Creating VDOM links
- Deleting VDOM links
- NAT to Transparent VDOM links

Viewing VDOM links

VDOM links are displayed on the network interface list in the web-based manager. You can view VDOM links only if you are using a super_admin account and in global configuration.

To view the network interface list, in the Global menu go to **System > Network > Interfaces**.

Interface list displaying interface names and information

Name	IP/Netmask	Type	Access	Administrative Status	Virtual Domain
port1 (External)	172.20.120.170 / 255.255.255.0	Physical	HTTPS,PING,SSH	On	root
port2 (Internal)	10.11.102.2 / 255.255.255.0	Physical	PING	On	root
VLAN_100_INT	10.11.101.2 / 255.255.255.0	VLAN	PING,SSH	On	Company_A
VLAN_200_INT	10.12.101.2 / 255.255.255.0	VLAN	PING,SSH	On	Company_B
port3 (DMZ)	172.20.130.10 / 255.255.255.0	Physical	PING	On	root
port4	0.0.0.0 / 0.0.0.0	Physical	PING	Off	root
port5	0.0.0.0 / 0.0.0.0	Physical	HTTPS,PING,SSH	Off	Company_B
port6	0.0.0.0 / 0.0.0.0	Physical	HTTPS,PING,SSH	Off	Company_A
port7	0.0.0.0 / 0.0.0.0	Physical	PING	Off	root
port8 (External)	-	Physical	HTTPS,PING,SSH	On	tpvDOM
tpvLAN111	-	VLAN	PING	On	tpvDOM
port9	0.0.0.0 / 0.0.0.0	Physical	PING	Off	vdem2
port10	10.13.201.2 / 255.255.255.0	Physical	HTTPS,PING,SSH	On	root
testLink (VDOM Link)	-	VDOM Link	-	-	root, vdem2
testLink0	0.0.0.0 / 0.0.0.0	Pair	HTTPS,PING,SSH	On	root
testLink1	0.0.0.0 / 0.0.0.0	Pair	HTTPS,PING,SSH	On	vdem2

Annotations in the image:
 - "VDOM link interface" points to the 'testLink' row.
 - "VDOM link pair" points to the 'testLink0' and 'testLink1' rows.

Create New

Select the arrow to create a new interface or VDOM link. Interface options include VLAN, Aggregate, Redundant, or loopback interfaces.

For more information, see [Creating VDOM links](#).

Edit	<p>Select to change interface configuration for the selected interface.</p> <p>This option not available if no interfaces or multiple interfaces are selected.</p>
Delete	<p>Select to remove an interface from the list. One or more interfaces must be selected for this option to be available.</p> <p>You cannot delete permanent physical interfaces, or any interfaces that have configuration referring to them. See Deleting VDOM links or see Deleting an interface.</p>
Column Settings	Select to change which information is displayed about the interfaces, and in which order the columns appear. Use to display VDOM, VLAN, and other information.
Checkbox	<p>Select the checkbox for an interface to edit or delete that interface.</p> <p>Select multiple interfaces to delete those interfaces.</p> <p>Optionally select the check box at the top of the column to select or unselect all checkboxes.</p>
Name	<p>The name of the interface.</p> <p>The name of the VDOM link (<code>vlink1</code>) has an expand arrow to display or hide the pair of VDOM link interfaces. For more information, see Viewing VDOM links.</p>
IP/Netmask	The IP address and netmask assigned to this interface.
Type	The type of interface such as physical, VLAN, or VDOM link pair.
Access	The protocols allowed for administrators to connect to the FortiGate unit.
Administrative Status	The status of this interface, either set to up (active) or down (disabled).
Virtual Domain	The virtual domain this interface belongs to. For more information on VDOMs, see Virtual Domains in NAT/Route mode .

Creating VDOM links

VDOM links connect VDOMs together to allow traffic to pass between VDOMs as per firewall policies. Inter-VDOM links are virtual interfaces that are very similar to VPN tunnel interfaces except inter-VDOM links do not require IP addresses. See [IP addresses and inter-VDOM links](#).

To create a VDOM link, you first create the point-to-point interface, and then bind the two interface objects associated with it to the virtual domains.

In creating the point-to-point interface, you also create two additional interface objects by default. They are called `vlink10` and `vlink11` - the interface name you chose with a 1 or a 0 to designate the two ends of the link.

Once the interface objects are bound, they are treated like normal FortiGate interfaces and need to be configured just like regular interfaces.

The assumptions for this example are as follows:

- Your FortiGate unit has VDOMs enabled and you have 2 VDOMs called `customer1` and `customer2` already configured. For more information on configuring VDOMs see [Configuring Virtual Domains](#).
- You are using a `super_admin` account

To configure an inter-VDOM link - web-based manager:

1. Go to **Global > Network > Interfaces**.
2. Select **Create New > VDOM link**, enter the following information, and select **OK**.

Name	vlink1
	(The name can be up to 11 characters long. Valid characters are letters, numbers, "-", and "_". No spaces are allowed.)
Interface #0	
Virtual Domain	customer1
IP/Netmask	10.11.12.13/255.255.255.0
Administrative Access	HTTPS, SSL
Interface #1	
Virtual Domain	customer2
IP/Netmask	172.120.100.13/255.255.255.0
Administrative Access	HTTPS, SSL

To configure an inter-VDOM link - CLI:

```
config global
  config system vdom-link
    edit vlink1
  end
  config system interface
    edit vlink10
      set vdom customer1
    next
    edit vlink11
      set vdom customer2
    end
  end
end
```

Once you have created and bound the interface ends to VDOMs, configure the appropriate firewall policies and other settings that you require. To confirm the inter-VDOM link was created, find the VDOM link pair and use the expand arrow to view the two VDOM link interfaces. You can select edit to change any information.

IP addresses and inter-VDOM links

Besides being virtual interfaces, here is one main difference between inter-VDOM links and regular interfaces—default inter-VDOM links do not require IP addresses. IP addresses are not required by default because an inter-VDOM link is an internal connection that can be referred to by the interface name in firewall policies, and other system references. This introduces three possible situations with inter-VDOM links that are:

- **unnumbered** - an inter-VDOM link with no IP addresses for either end of the tunnel
- **half numbered** - an inter-VDOM link with one IP address for one end and none for the other end
- **full numbered** - an inter-VDOM link with two IP addresses, one for each end.

Not using an IP address in the configuration can speed up and simplify configuration for you. Also you will not use up all the IP addresses in your subnets if you have many inter-VDOM links.

Half or full numbered interfaces are required if you are doing NAT, either SNAT or DNAT as you need an IP number on both ends to translate between.

You can use unnumbered interfaces in static routing, by naming the interface and using 0.0.0.0 for the gateway. Running traceroute will not show the interface in the list of hops. However you can see the interface when you are sniffing packets, which is useful for troubleshooting.

Deleting VDOM links

When you delete the VDOM link, the two link objects associated with it will also be deleted. You cannot delete the objects by themselves. The example uses a VDOM routing connection called “vlink1”. Removing vlink1 will also remove its two link objects vlink10 and vlink11.



Before deleting the VDOM link, ensure all policies, firewalls, and other configurations that include the VDOM link are deleted, removed, or changed to no longer include the VDOM link.

To remove a VDOM link - web-based manager:

1. Go to **Global > Network > Interfaces**.
2. Select **Delete** for the VDOM link **vlink1**.

To remove a VDOM link - CLI:

```
config global
  config system vdom-link
    delete vlink1
  end
```

For more information, see the [FortiGate CLI Reference](#).

NAT to Transparent VDOM links

Inter-VDOM links can be created between VDOMs in NAT mode and VDOMs in Transparent mode, but it must be done through the CLI, as the VDOM link type must be changed from the default PPP to Ethernet for the two VDOMs to communicate. The below example assumes one vdom is in NAT mode and one is Transparent.



An IP address must be assigned to the NAT VDOM's interface, but no IP address should be assigned to the Transparent VDOM's interface.

To configure a NAT to Transparent VDOM link - CLI:

```
config global
  config system vdom-link
    edit vlink1
      set type ethernet
    end
  config system interface
    edit vlink10
      set vdom (interface 1 name)
      set ip (interface 1 ip)
    next
    edit vlink11
      set vdom (interface 2 name)
    end
```

Ethernet-type is not recommended for standard NAT to NAT inter-VDOM links, as the default PPP-type link does not require the VDOM links to have addresses, while Ethernet-type does. VDOM link addresses are explained in [IP addresses and inter-VDOM links](#).

Inter-VDOM configurations

By using fewer physical interfaces to inter-connect VDOMs, inter-VDOM links provide you with more configuration options.

None of these configurations use VLANs to reduce the number of physical interfaces. It is generally assumed that an internal or client network will have its own internal interface and an external interface to connect to its ISP and the Internet.

These inter-VDOM configurations can use any FortiGate model with possible limitations based on the number of physical interfaces. VLANs can be used to work around these limitations.

In the following inter-VDOM diagrams, red indicates the physical FortiGate unit, grey indicate network connections external to the FortiGate unit, and black is used for inter-VDOM links and VDOMs.

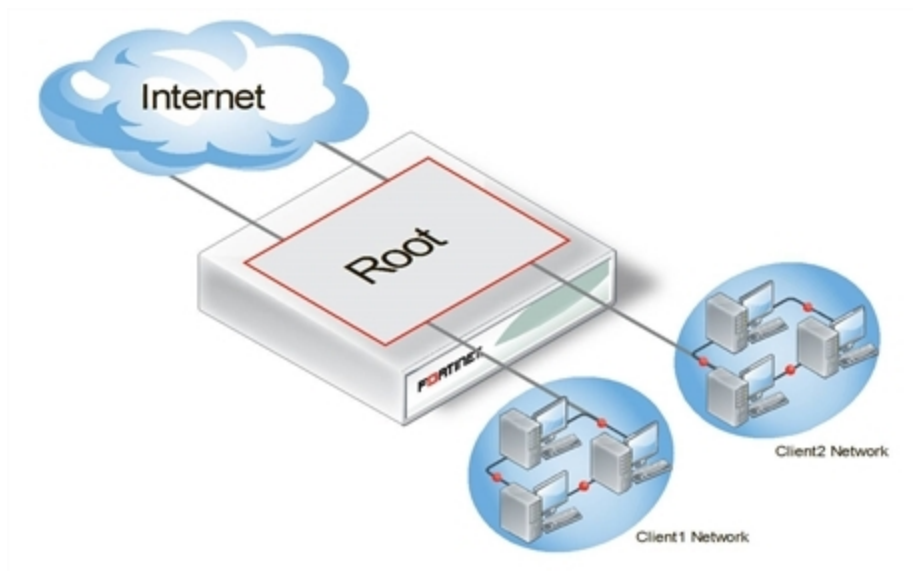
This section includes the following topics:

- [Standalone VDOM configuration](#)
- [Independent VDOMs configuration](#)
- [Management VDOM configuration](#)
- [Meshed VDOM configuration](#)

Standalone VDOM configuration

The standalone VDOM configuration uses a single VDOM on your FortiGate unit — the root VDOM that all FortiGate units have by default. This is the VDOM configuration you are likely familiar with. It is the default configuration for FortiGate units before you create additional VDOMs.

Standalone VDOM



The configuration shown above has no VDOM inter-connections and requires no special configurations or settings.

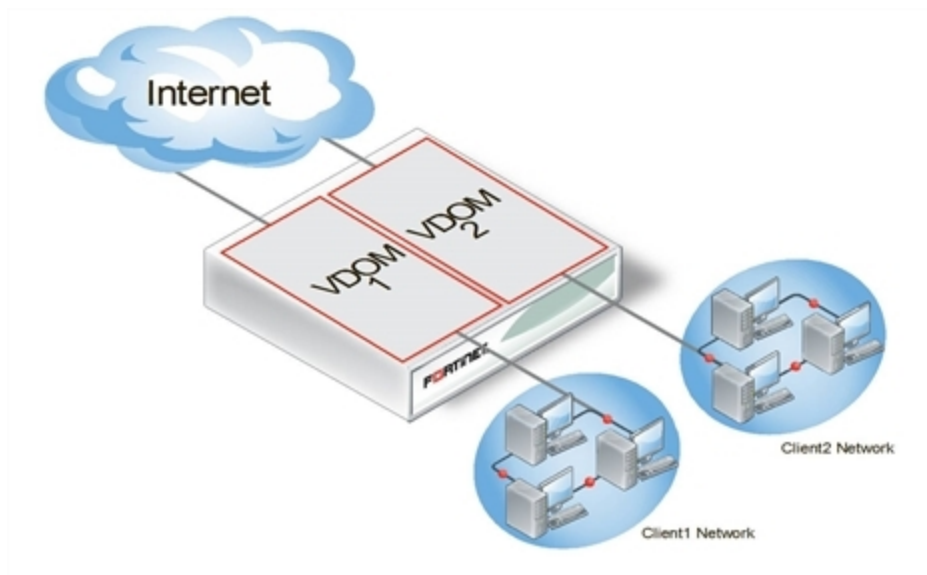
The standalone VDOM configuration can be used for simple network configurations that only have one department or one company administering the connections, firewalls and other VDOM-dependent settings.

However, with this configuration, keeping client networks separate requires many interfaces, considerable firewall design and maintenance, and can quickly become time consuming and complex. Also, configuration errors for one client network can easily affect other client networks, causing unnecessary network downtime.

Independent VDOMs configuration

The independent VDOMs configuration uses multiple VDOMs that are completely separate from each other. This is another common VDOM configuration.

Independent VDOMs



This configuration has no communication between VDOMs and apart from initially setting up each VDOM, it requires no special configurations or settings. Any communication between VDOMs is treated as if communication is between separate physical devices.

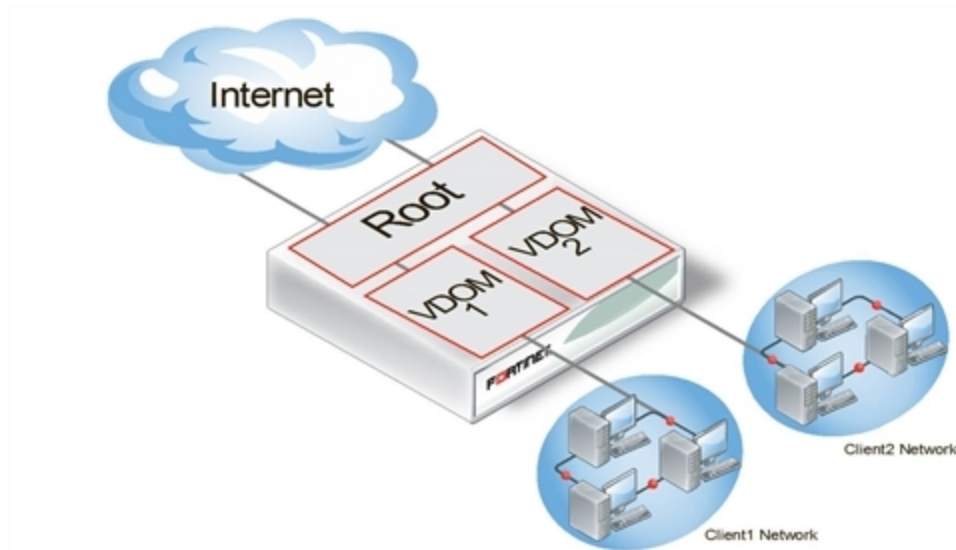
The independent inter-VDOM configuration can be used where more than one department or one company is sharing the FortiGate unit. Each can administer the connections, firewalls and other VDOM-dependent settings for only its own VDOM. To each company or department, it appears as if it has its own FortiGate unit. This configuration reduces the amount of firewall configuration and maintenance required by dividing up the work.

However, this configuration lacks a management VDOM for VDOMs 1, 2, and 3. This is illustrated in Figure 50. This management VDOM would enable an extra level of control for the FortiGate unit administrator, while still allowing each company or department to administer its own VDOM.

Management VDOM configuration

In the management VDOM configuration, the root VDOM is the management VDOM. The other VDOMs are connected to the management VDOM with inter-VDOM links. There are no other inter-VDOM connections.

Management VDOM configuration



The inter-VDOM links connect the management VDOM to the other VDOMs. This does not require any physical interfaces, and the bandwidth of inter-VDOM links can be faster than physical interfaces, depending on the CPU workload.

Only the management VDOM is connected to the Internet. The other VDOMs are connected to internal networks. All external traffic is routed through the management VDOM using inter-VDOM links and firewall policies between the management VDOM and each VDOM. This ensures the management VDOM has full control over access to the Internet, including what types of traffic are allowed in both directions. There is no communication directly between the non-root VDOMs. Security is greatly increased with only one point of entry and exit. Only the management VDOM needs to be fully managed to ensure network security in this case. Each client network can manage its own configuration without compromising security or bringing down another client network.

The management VDOM configuration is ideally suited for a service provider business. The service provider administers the management VDOM with the other VDOMs as customers. These customers do not require a dedicated IT person to manage their network. The service provider controls the traffic and can prevent the customers from using banned services and prevent Internet connections from initiating those same banned services. One example of a banned service might be Instant Messaging (IM) at a company concerned about intellectual property. Another example could be to limit bandwidth used by file-sharing applications without banning that application completely. Firewall policies control the traffic between the customer VDOM and the management VDOM and can be customized for each customer.

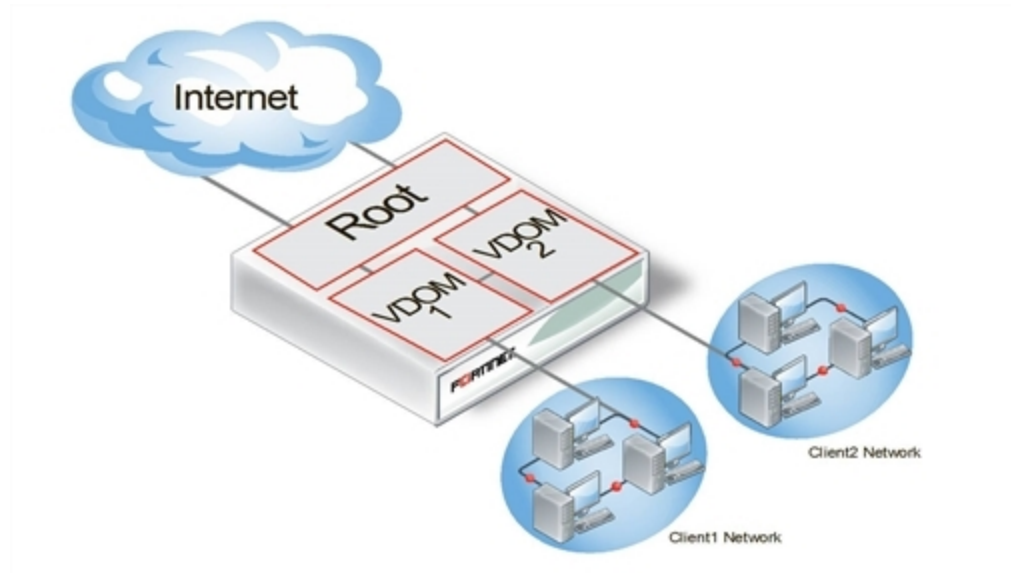
The management VDOM configuration is limited in that the customer VDOMs have no inter-connections. In many situations this limitation is ideal because it maintains proper security. However, some configurations may require customers to communicate with each other, which would be easier if the customer VDOMs were inter-connected.

Meshed VDOM configuration

The meshed VDOMs configuration, including partial and full mesh, has VDOMs inter-connected with other VDOMs. There is no special feature to accomplish this—they are just complex VDOM configurations.

Partial mesh means only some VDOMs are inter-connected. In a full mesh configuration, all VDOMs are inter-connected to all other VDOMs. This can be useful when you want to provide full access between VDOMs but handle traffic differently depending on which VDOM it originates from or is going to.

Meshed VDOMs



With full access between all VDOMs being possible, it is extra important to ensure proper security. You can achieve this level of security by establishing extensive firewall policies and ensuring secure account access for all administrators and users.

Meshed VDOM configurations can become complex very quickly, with full mesh VDOMs being the most complex. Ensure this is the proper solution for your situation before using this configuration. Generally, these configurations are seen as theoretical and are rarely deployed in the field.

Dynamic routing over inter-VDOM links

BGP is supported over inter-VDOM links. Unless otherwise indicated, routing works as expected over inter-VDOM links.

If an inter-VDOM link has no assigned IP addresses to it, it may be difficult to use that interface in dynamic routing configurations. For example BGP requires an IP address to define any BGP router added to the network.

In OSPF, you can configure a router using a router ID and not its IP address. In fact, having no IP address avoids possible confusing between which value is the router ID and which is the IP address. However for that router to become adjacent with another OSPF router it will have to share the same subnet, which is technically impossible without an IP address. For this reason, while you can configure an OSPF router using an IP-less inter-VDOM link, it will likely be of limited value to you.

In RIP the metric used is hop count. If the inter-VDOM link can reach other nodes on the network, such as through a default route, then it may be possible to configure a RIP router on an inter-VDOM link. However, once again it may be of limited value due to limitations.

As stated earlier, BGP requires an IP address to define a router — an IP-less inter-VDOM link will not work with BGP.

In Multicast, you can configure an interface without using an IP address. However that interface will be unable to become an RP candidate. This limits the roles available to such an interface.

HA virtual clusters and VDOM links

FortiGate HA is implemented by configuring two or more FortiGate units to operate as an HA cluster. To the network, the HA cluster appears to function as a single FortiGate unit, processing network traffic and providing normal security services such as firewall, VPN, IPS, virus scanning, web filtering, and spam filtering.

Virtual clustering extends HA features to provide failover protection and load balancing for a FortiGate unit operating with virtual domains. A virtual cluster consists of a cluster of two FortiGate units operating with virtual domains. Traffic on different virtual domains can be load balanced between the cluster units.

With virtual clusters (vclusters) configured, inter-VDOM links must be entirely within one vcluster. You cannot create links between vclusters, and you cannot move a VDOM that is linked into another virtual cluster. If your FortiGate units are operating in HA mode, with multiple vclusters when you create the vdom-link, the CLI command `config system vdom-link` includes an option to set which vcluster the link will be in.

What is virtual clustering?

Virtual clustering is an extension of the FGCP for FortiGate units operating with multiple VDOMS enabled. Virtual clustering operates in active-passive mode to provide failover protection between two instances of a VDOM operating on two different cluster units. You can also operate virtual clustering in active-active mode to use HA load balancing to load balance sessions between cluster units. Alternatively, by distributing VDOM processing between the two cluster units you can also configure virtual clustering to provide load balancing by distributing sessions for different VDOMs to each cluster unit.

Virtual clustering and failover protection

Virtual clustering operates on a cluster of two (and only two) FortiGate units with VDOMs enabled. Each VDOM creates a cluster between instances of the VDOMs on the two FortiGate units in the virtual cluster. All traffic to and from the VDOM stays within the VDOM and is processed by the VDOM. One cluster unit is the primary unit for each VDOM and one cluster unit is the subordinate unit for each VDOM. The primary unit processes all traffic for the VDOM. The subordinate unit does not process traffic for the VDOM. If a cluster unit fails, all traffic fails over to the cluster unit that is still operating.

Virtual clustering and heartbeat interfaces

The HA heartbeat provides the same HA services in a virtual clustering configuration as in a standard HA configuration. One set of HA heartbeat interfaces provides HA heartbeat services for all of the VDOMs in the cluster. You do not have to add a heartbeat interface for each VDOM.

Virtual clustering and HA override

For a virtual cluster configuration, override is enabled by default for both virtual clusters when you:

- Enable VDOM portioning from the web-based manager by moving virtual domains to virtual cluster 2
- Enter `set vcluster2 enable` from the CLI `config system ha` command to enable virtual cluster 2.

Usually you would enable virtual cluster 2 and expect one cluster unit to be the primary unit for virtual cluster 1 and the other cluster unit to be the primary unit for virtual cluster 2. For this distribution to occur override must be enabled for both virtual clusters. Otherwise you will need to restart the cluster to force it to renegotiate.

Virtual clustering and load balancing or VDOM partitioning

There are two ways to configure load balancing for virtual clustering. The first is to set the HA mode to active-active. The second is to configure VDOM partitioning. For virtual clustering, setting the HA Mode to active-active has the same result as active-active HA for a cluster without virtual domains. The primary unit receives all sessions and load balances them among the cluster units according to the load balancing schedule. All cluster units process traffic for all virtual domains.

Note: If override is enabled the cluster may renegotiate too often. You can choose to disable override at any time. If you decide to disable override, for best results, you should disable it for both cluster units.

In a VDOM partitioning virtual clustering configuration, the HA mode is set to active-passive. Even though virtual clustering operates in active-passive mode you can configure a form of load balancing by using VDOM partitioning to distribute traffic between both cluster units. To configure VDOM partitioning you set one cluster unit as the primary unit for some virtual domains and you set the other cluster unit as the primary unit for other virtual domains. All traffic for a virtual domain is processed by the primary unit for that virtual domain. You can control the distribution of traffic between the cluster units by adjusting which cluster unit is the primary unit for each virtual domain.

For example, you could have 4 VDOMs, two of which have a high traffic volume and two of which have a low traffic volume. You can configure each cluster unit to be the primary unit for one of the high volume VDOMs and one of the low volume VDOMs. As a result each cluster unit will be processing traffic for a high volume VDOM and a low volume VDOM, resulting in an even distribution of traffic between the cluster units. You can adjust the distribution at any time. For example, if a low volume VDOM becomes a high volume VDOM you can move it from one cluster unit to another until the best balance is achieved. From the web-based manager you configure VDOM partitioning by setting the HA mode to active-passive and distributing virtual domains between Virtual Cluster 1 and Virtual Cluster 2. You can also configure different device priorities, port monitoring, and remote link failover, for Virtual Cluster 1 and Virtual Cluster 2.

From the CLI you configure VDOM partitioning by setting the HA mode to a-p. Then you configure device priority, port monitoring, and remote link failover and specify the VDOMs to include in virtual cluster 1. You do the same for virtual cluster 2 by entering the config secondary-vcluster command.

Failover protection does not change. If one cluster unit fails, all sessions are processed by the remaining cluster unit. No traffic interruption occurs for the virtual domains for which the still functioning cluster unit was the primary unit. Traffic may be interrupted temporarily for virtual domains for which the failed unit was the primary unit while processing fails over to the still functioning cluster unit. If the failed cluster unit restarts and rejoins the virtual cluster, VDOM partitioning load balancing is restored.

Example of inter-VDOM routing

This example shows how to configure a FortiGate unit to use inter-VDOM routing.

This section contains the follow topics:

- [Network topology and assumptions](#)
- [Creating the VDOMs](#)
- [Configuring the physical interfaces](#)

- [Configuring the VDOM links](#)
- [Configuring the firewall and Security Profile settings](#)
- [Testing the configuration](#)

Network topology and assumptions

Two departments of a company, Accounting and Sales, are connected to one FortiGate-800 unit. To do its work, the Sales department receives a lot of email from advertising companies that would appear to be spam if the Accounting department received it. For this reason, each department has its own VDOM to keep firewall policies and other configurations separate. A management VDOM makes sense to ensure company policies are followed for traffic content.

The traffic between Accounting and Sales will be email and HTTPS only. It could use a VDOM link for a meshed configuration, but we will keep from getting too complex. With the configuration, inter-VDOM traffic will have a slightly longer path to follow than normal—from one department VDOM, through the management VDOM, and back to the other department VDOM. Since inter-VDOM links are faster than physical interfaces, this longer path should not be noticed.

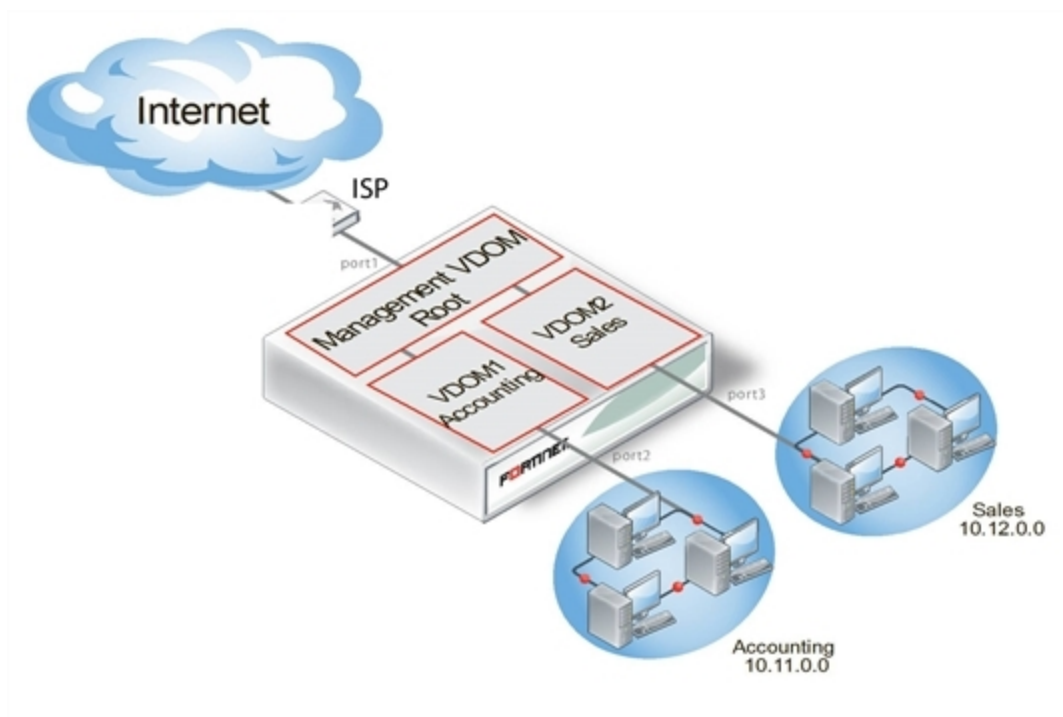
Firewall policies will be in place. For added security, firewall policies will allow only valid office services such as email, web browsing, and FTP between either department and the Internet. Any additional services that are required can be added in the future.

The company uses a single ISP to connect to the Internet. The ISP uses DHCP to provide an IP address to the FortiGate unit. Both departments use the same ISP to reach the Internet.

Other assumptions for this example are as follows:

- Your FortiGate unit has interfaces labelled port1 through port4 and VDOMs are not enabled.
- You are using the super_admin account.
- You have the FortiClient application installed.
- You are familiar with configuring interfaces, firewalls, and other common features on your FortiGate unit.

Management VDOM for two departments



General configuration steps

This example includes the following general steps. For best results, follow the steps in the order given. Also, note that if you perform any additional actions between procedures, your configuration may have different results.

1. [Creating the VDOMs](#)
2. [Configuring the physical interfaces](#)
3. [Configuring the VDOM links](#)
4. [Configuring the firewall and Security Profile settings](#)
5. [Testing the configuration](#)

Creating the VDOMs

This procedure enables VDOMs and creates the Sales and Accounting VDOMs.

To create the VDOMs - web-based manager:

1. Log in as the super_admin administrator.
2. Go to **System > Dashboard > Status > System Information > Virtual Domain**, and select **Enable**.
3. Log in again.
4. Go to **System > VDOM > VDOM**.
5. Select **Create New**, enter *Accounting* for the VDOM Name, and select **OK**.
6. Select **Create New**, enter *Sales* for the VDOM Name, and select **OK**.

To create the VDOMs - CLI:

```

config system global
    set vdom enable
end
config system vdom
    edit Accounting
    next
    edit Sales
    next
end

```

Configuring the physical interfaces

Next, the physical interfaces must be configured. This example uses three interfaces on the FortiGate unit - port2 (internal), port3(dmz), and port1(external). port2 and port3 interfaces each have a department's network connected. port1 is for all traffic to or from the Internet and will use DHCP to configure its IP address, which is common with many ISPs.

To configure the physical interfaces - web-based manager:

1. Go to **Global > Network > Interfaces**.
2. Select **Edit** for the port2 interface, enter the following information, and select **OK**.

Alias	AccountingLocal
Virtual Domain	Accounting
Addressing mode	Manual
IP/Netmask	172.100.1.1/255.255.0.0
Administrative Access	HTTPS, PING, SSH
Description	This is the accounting department internal interface.

3. Select **Edit** for the port3 interface, enter the following information, and select **OK**.

Alias	SalesLocal
Virtual Domain	Sales
Addressing mode	Manual
IP/Netmask	192.168.1.1/255.255.0.0
Administrative Access	HTTPS, PING, SSH
Description	This is the sales department internal interface.

4. Select **Edit** for the port1 interface, enter the following information, and select **OK**.

Alias	ManagementExternal
Virtual Domain	root
Addressing Mode	DHCP
Distance	5
Retrieve default gateway from server	Enable
Override internal DNS	Enable
Administrative Access	HTTPS, SSH, SNMP
Description	This is the accounting department internal interface.



When the mode is set to DHCP or PPoE on an interface you can set the distance field. This is the administrative distance for any routes learned through the gateway for this interface. The gateway is added to the static route table with these values. A lower distance indicates a preferred route.

To configure the physical interfaces - CLI:

```
config global
config system interface
edit port2
set alias AccountingLocal
set vdom Accounting
set mode static
set ip 172.100.1.1 255.255.0.0
set allowaccess https ping ssh
set description "The accounting dept internal interface"
next
edit port3
set alias SalesLocal
set vdom Sales
set mode static
set ip 192.168.1.1 255.255.0.0
set allowaccess https ping ssh
set description "The sales dept. internal interface"
next
edit port1
set alias ManagementExternal
set vdom root
set mode DHCP
set distance 5
set gwdetect enable
set dns-server-override enable
set allowaccess https ssh snmp
set description "The systemwide management interface."
end
```


Configuring the VDOM links

To complete the connection between each VDOM and the management VDOM, you need to add the two VDOM links; one pair is the Accounting - management link and the other is for Sales - management link.

When configuring inter-VDOM links, you do not have to assign IP addresses to the links unless you are using advanced features such as dynamic routing that require them. Not assigning IP addresses results in faster configuration, and more available IP addresses on your networks.

If you require them, or if you simply want to assign IP addresses for clarity can do so.

To configure the Accounting and management VDOM link - web-based manager:

1. Go to **Global > Network > Interfaces**.
2. Select the expand arrow to select **Create New > VDOM link**.
3. Enter the following information, and select **OK**.

Name	AccountVlnk
Interface #0	
Virtual Domain	Accounting
IP/Netmask	0.0.0.0/0.0.0.0
Administrative Access	HTTPS, PING, SSH
Description	The Accounting VDOM side of the link.
Interface #1	
Virtual Domain	root
IP/Netmask	0.0.0.0/0.0.0.0
Administrative Access	HTTPS, PING, SSH
Description	The Management VDOM side of the link.

To configure the Accounting and management VDOM link - CLI:

```
config global
  config system vdom-link
    edit AccountVlnk
    next
  end
  config system interface
    edit AccountVlnk0
      set vdom Accounting
      set ip 0.0.0.0 0.0.0.0
      set allowaccess https ping ssh
      set description "Accounting side of the VDOM link"
```

```

next
edit AccountVlnk1
  set vdom root
  set ip 0.0.0.0 0.0.0.0
  set allowaccess https ping ssh
  set description "Management side of the VDOM link"
end

```

To configure the Sales and management VDOM link - web-based manager:

1. Go to **Global > Network > Interfaces**.
2. Select the expand arrow and select **Create New > VDOM link**.
3. Enter the following information, and select **OK**.

Name	SalesVlnk
Interface #0	
Virtual Domain	Sales
IP/Netmask	0.0.0.0/0.0.0.0
Administrative Access	HTTPS, PING, SSH
Description	The Sales VDOM side of the link.
Interface #1	
Virtual Domain	root
IP/Netmask	0.0.0.0/0.0.0.0
Administrative Access	HTTPS, PING, SSH
Description	The Management VDOM side of the link.

To configure the Sales and management VDOM link - CLI:

```

config global
  config system vdom-link
    edit SalesVlnk
  end
  config system interface
    edit SalesVlnk0
      set vdom Accounting
      set ip 0.0.0.0 0.0.0.0
      set allowaccess https ping ssh
      set description "Sales side of the VDOM link"
    next
    edit SalesVlnk1
      set vdom root
      set ip 0.0.0.0 0.0.0.0
      set allowaccess https ping ssh
      set description "Management side of the VDOM link"
    end
  end
end

```

```
end
end
```

Configuring the firewall and Security Profile settings

With the VDOMs, physical interfaces, and VDOM links configured the firewall must now be configured to allow the proper traffic. Firewalls are configured per-VDOM, and firewall objects must be created for each VDOM separately.

For this example, the firewall group of services allowed between the internal networks and the Internet are the basic services for web browsing, file transfer, and email. These include: HTTP, HTTPS, SSL, FTP, DNS, NTP, POP3, and SMTP.

The only services allowed between Sales and Accounting are secure web browsing (HTTPS) and email (POP3 and SMTP).



The limited number of services ensures security between departments. The list of services can be expanded in the future if needed.

Security profile settings will block all non-essential business websites while logging all web traffic, scan and file filter all web and email protocols, and block game and peer-to-peer applications using application control.

For added security, FortiClient is required on internal computers with AntiVirus scanning configured. This is enforced by **Endpoint NAC** in firewall policies.

Using firewall addresses makes the firewall policies easier to read. Also if any changes need to be made in the future, you can simply update the addresses without changing the firewall policies. The addresses required are:

- `AccountingLocal` - all traffic from the internal accounting network
- `AccountingVlnk` - all traffic from the VDOM link between accounting and management VDOMs
- `SalesLocal` - all traffic from the internal sales network
- `SalesVlnk` - all traffic from the VDOM link between sales and management VDOM.

The Accounting VDOM requires `AccountingLocal`, `AccountingVlnk`, and `SalesLocal`. The Sales VDOM requires `SalesLocal`, `SalesVlnk`, and `AccountingLocal`.

The firewall policies required on the Accounting VDOM are:

- AccountingLocal to Internet
- Internet to AccountingLocal
- SalesLocal to AccountingLocal
- AccountingLocal to SalesLocal

The firewall policies required on the Sales VDOM are:

- SalesLocal to Internet
- Internet to SalesLocal
- SalesLocal to AccountingLocal
- AccountingLocal to SalesLocal

This section includes the following topics:

- [Configuring firewall service groups](#)
- [Configuring Security Profile settings for the Accounting VDOM](#)
- [Configuring firewall settings for the Accounting VDOM](#)
- [Configuring Security Profile settings for the Sales VDOM](#)
- [Configuring firewall settings for the Sales VDOM](#)
- [Configuring firewall settings between the Accounting and Sales VDOMs](#)

Configuring firewall service groups

Service groups are an easy way to manage multiple services, especially if the same services are used on different networks.

The two service groups used here are intended for normal office traffic to the Internet, and for restricted traffic between departments. In both cases network traffic will be limited to the services listed to prevent any potential security risks or bandwidth-robbing applications.

These service groups can be changed as needed to either include additional valid services that are being used on the network, or to exclude services that are not required. Also, custom services can be created as needed for applications that are not listed.

To configure two firewall service groups - web-based manager:

1. Open the **Accounting** VDOM.
2. Go to **Firewall Objects > Service > Group**.
3. Select **Create New**, enter the following information, and select **OK**.

Group Name	OfficeServices
Members	HTTP, HTTPS, SSL, FTP, DNS, NTP, POP3, PING, SMTP

4. Select **Create New**, enter the following information, and select **OK**.

Group Name	AccountingSalesServices
Members	HTTPS, POP3, PING, SMTP

To configure two firewall service groups - CLI:

```
config vdom
  edit Accounting
    config firewall service group
      edit OfficeServices
        set member HTTP HTTPS SSH FTP DNS NTP POP3 PING SMTP
      next
      edit AccountingSalesServices
        set member HTTPS POP3 PING SMTP
      end
    end
  end
```

Configuring Security Profile settings for the Accounting VDOM

Security Profile settings include web filtering, antivirus, application control, and other features. This example just uses those three features to ensure that

- the business environment is free from viruses
- employees do not surf grossly inappropriate websites, and
- employees do not use games or peer-to-peer applications at work.

To configure web filtering for the Accounting VDOM - web-based manager:

1. Open the **Accounting** VDOM.
2. Go to **Security Profiles > Web Filter > Profile**.
3. Select **Create New**.
4. Enter `webStrict` for the **Name**.
5. Select the arrow to expand the **FortiGuard Web Filtering** section.
6. Block all **Categories** except Business Oriented, Other, and Unrated.
7. Block all **Classifications** except Image Search..
8. Log all **Categories** and **Classifications**.
9. Select **OK**.

To configure AntiVirus for the Accounting VDOM - web-based manager:

1. Open the **Accounting** VDOM.
2. Go to **Security Profiles > AntiVirus > Profile**.
3. Select **Create New**.
4. Enter `avStrict` for the **Name**.
5. Enable **Scan** for all protocols.
6. Enable **File filter** for all protocols, and select `built-in-patterns` for **Option**.
7. Enable logging for both **Scan** and **File Filter**.
8. Select **OK**.

To configure application control for the Accounting VDOM - web-based manager:

1. Open the **Accounting** VDOM.
2. Go to **Security Profiles > Application Control > Application Sensor**.
3. Select **Create New** (+ button at top right of page).
4. Enter `appStrict` for **Name** and select **OK**.
5. Select **Create New**.
6. In **Filters**, set **Category** to **game**.
7. In **Applications/Settings**, enter the following, and select **OK**.

Action	Block
Packet Logging	Enable

8. Select **Create New**.
9. In **Filters**, set **Category** to **p2p**.
10. In **Applications/Settings**, enter the following, and select **OK**.

Action	Block
Packet Logging	Enable

11. Select **Apply**.

To configure application control for the Accounting VDOM - CLI:

```
config vdom
  edit Accounting
    config application list
      edit appStrict
        config entries
          edit 1
            set category 2
          next
          edit 2
            set category 8
          end
        end
      end
    end
  end
```

Configuring firewall settings for the Accounting VDOM

This configuration includes two firewall addresses and two firewall policies for the Accounting VDOM - one for the internal network, and one for the VDOM link with the management VDOM (root).

For added security, all traffic allowed will be scanned. Only valid office traffic will be allowed using the service group *OfficeServices*. The FortiClient application must be used to ensure additional protection for the sensitive accounting information.

All sales and accounting computers have the FortiClient application installed, so the firewall policies check that FortiClient is installed and that antivirus scanning is enabled.

Note the spelling of *AccountVlnk* which is due to the eleven character limit on VDOM link names.

To configure firewall addresses - web-based manager:

1. Open the **Accounting VDOM**.
2. Select **Firewall Objects > Address > Address**
3. Select **Create New**, enter the following information, and select **OK**.

Address Name	AccountingLocal
Type	Subnet/ IP Range
Subnet / IP Range	172.100.0.0
Interface	port1

4. Select **Create New**, enter the following information, and select **OK**.

Address Name	AccountManagement
Type	Subnet/ IP Range
Subnet / IP Range	10.0.1.0
Interface	AccountVlnk

To configure firewall addresses - CLI:

```
config vdom
  edit Accounting
    config firewall address
      edit AccountingLocal
        set type iprange
        set subnet 172.100.0.0
        set associated-interface port1
      next
      edit AccountManagement
        set type iprange
        set subnet 10.0.1.0
        set associated-interface AccountVlnk
      end
    end
  end
```

To configure protocol options for Accounting VDOM - web-based manager:

1. Open the **Accounting** VDOM.
2. Select **Policy > Policy > Protocol Options**.
3. Select **Create New**.
4. Enter `default` for the **Name**.
5. Select **OK**.

To configure the firewall policies from AccountingLocal to the Internet - web-based manager:

1. Open the **Accounting** VDOM.
2. Go to **Policy > Policy**.
3. Select **Create New**, enter the following information, and then select **OK**.

Source Interface/Zone	port2
Source Address	AccountingLocal
Destination Interface/Zone	AccountVlnk
Destination Address	AccountManagement
Schedule	always
Service	OfficeServices

Action	ACCEPT
Enable NAT	enable
Security Features	enabled
Protocol Option	default
Web Filtering	webStrict
AntiVirus Filtering	avStrict
Application Control	appStrict
Enable Endpoint NAC	Enforce_FortiClient_AV

4. Open the **root** VDOM.
5. Go to **Policy > Policy**.
6. Select **Create New**, enter the following information, and then select **OK**.

Source Interface/Zone	AccountVlnk
Source Address	AccountManagement
Destination Interface/Zone	port2
Destination Address	all
Schedule	always
Service	OfficeServices
Action	ACCEPT
Enable NAT	enable
Security Features	enabled
Protocol Option	default
Web Filtering	webStrict
AntiVirus Filtering	avStrict
Application Control	appStrict
Enable Endpoint NAC	disabled

To configure the firewall policies from **AccountingLocal** to **Internet** - CLI:

```
config vdom
edit Accounting
```



```

config firewall policy
  edit 1
    set srcintf "port2"
    set dstintf "AccountVlnk"
    set srcaddr "AccountingLocal"
    set dstaddr "AccountManagement"
    set action accept
    set schedule "always"
    set service "OfficeServices"
    set nat enable
    set av-profile avStrict
    set webfilter-profile webStrict
    set application-list appStrict
    set profile-protocol-options default
    set endpoint-check enable
    set endpoint-profile "FortiClient_installed"
  end
end
config vdom
  edit root
    config firewall policy
      edit 2
        set srcintf AccountVlnk
        set dstintf port1
        set srcaddr AccountManagement
        set dstaddr all
        set action accept
        set schedule always
        set service OfficeServices
        set nat enable
        set av-profile "scan"
        set webfilter-profile "scan"
        set application-list "AppControlList"
        set profile-protocol-options default
        set endpoint-check disable
      end
    end
  end
end

```

To configure the firewall policies from Internet to AccountingLocal - web-based manager:

1. Open the **root** VDOM.
2. Go to **Policy > Policy**.
3. Select **Create New**, enter the following information, and select **OK**.

Source Interface/Zone	port1
Source Address	all
Destination Interface/Zone	AccountVlnk
Destination Address	AccountManagement
Schedule	always

Service	OfficeServices
Action	ACCEPT
Enable NAT	enable
Security Features	enabled
Protocol Option	default
Web Filtering	webStrict
AntiVirus Filtering	avStrict
Application Control	appStrict
Enable Endpoint NAC	disabled

4. Open the **Accounting** VDOM.
5. Go to **Policy > Policy**.
6. Select **Create New**, enter the following information, and select **OK**.

Source Interface/Zone	AccountVlnk
Source Address	AccountManagement
Destination Interface/Zone	port2
Destination Address	AccountingLocal
Schedule	always
Service	OfficeServices
Action	ACCEPT
Enable NAT	enable
Security Features	enabled
Protocol Option	default
Web Filtering	webStrict
AntiVirus Filtering	avStrict
Application Control	appStrict
Enable Endpoint NAC	disabled

To configure the firewall policies from Internet to AccountingLocal - CLI:

```
config vdom
  edit root
    config firewall policy
      edit 3
        set srcintf port1
        set dstintf AccountVlnk
        set srcaddr all
        set dstaddr AccountManagement
        set action accept
        set schedule always
        set service OfficeServices
        set nat enable
        set av-profile avStrict
        set webfilter-profile webStrict
        set application-list appstrict
        set profile-protocol-options default
        set endpoint-check disable
      end
    end
  config vdom
    edit Accounting
      config firewall policy
        edit 4
          set srcintf AccountVlnk
          set dstintf port2
          set srcaddr AccountManagement
          set dstaddr AccountingLocal
          set action accept
          set schedule always
          set service OfficeServices
          set nat enable
          set av-profile avStrict
          set webfilter-profile webStrict
          set application-list appstrict
          set profile-protocol-options default
          set endpoint-check disable
        end
      end
    end
  end
```

Configuring Security Profile settings for the Sales VDOM

Security profile settings include web filtering, antivirus, application control, and other features. This example just uses those three features to ensure that

- the business environment is free from viruses
- employees do not surf grossly inappropriate websites, and
- employees do not use games or peer-to-peer applications at work.

Note that Sales web traffic is different from Accounting, and web filtering is different to account for this.

To configure web filtering for the Sales VDOM - web-based manager:

1. Open the **Sales** VDOM.
2. Go to **Security Profiles > Web Filter > Profile**.
3. Select **Create New**.
4. Enter `webStrict` for the **Name**.
5. In **FortiGuard Categories**, select all of the categories except **Bandwidth Consuming**, **General Interest - Business** and **Unrated**.
6. In **Change Action for Selected Categories** select **Block**.
7. Select **Apply**.

To configure web filtering for the Sales VDOM - CLI:

```
config vdom
  edit Sales
    config webfilter profile
      edit webStrict
        config ftgd-wf
          set allow g07 g08 g21 g22 c01 c03
          set deny g01 g02 g03 g04 g05 g06 c02 c04 c05 c06 c07
        end
        set web-ftgd-err-log enable
      end
    end
  end
```

To configure AntiVirus for the Sales VDOM - web-based manager:

1. Open the **Sales** VDOM.
2. Go to **Security Profiles > AntiVirus > Profile**.
3. Select **Create New**.
4. Enter `avStrict` for the **Name**.
5. Enable virus scan for all protocols.
6. Select **Apply**.

To configure AntiVirus for the Sales VDOM - CLI:

```
config vdom
  edit Sales
    config antivirus profile
      edit "avStrict"
        config http
          set options scan file-filter
        end
        config ftp
          set options scan file-filter
        end
        config imap
          set options scan file-filter
        end
        config pop3
          set options scan file-filter
        end
      end
    end
  end
```

```

        config smtp
            set options scan file-filter
        end
        config nntp
            set options scan file-filter
        end
        config im
            set options scan file-filter
        end
        set filepattable 1
        set av-virus-log enable
        set av-block-log enable
    end
end

```

To configure application control for the Sales VDOM - web-based manager:

1. Open the **Accounting** VDOM.
2. Go to **Security Profiles > Application Control > Application Sensor**.
3. Select **Create New** (+ button at top right of page).
4. Enter `appStrict` for **Name** and select **OK**.
5. Select **Create New**.
6. In **Filters**, set **Category** to **game**.
7. In **Applications/Settings**, enter the following, and select **OK**.

Action	Block
Packet Logging	Enable

8. Select **Create New**.
9. In **Filters**, set **Category** to **p2p**.
10. In **Applications/Settings**, enter the following, and select **OK**.

Action	Block
Packet Logging	Enable

11. Select **Apply**.

To configure application control for the Sales VDOM - CLI:

```

config vdom
    edit Sales
        config application list
            edit "appStrict"
                config entries
                    edit 1
                        set category 2
                    next
                    edit 2
                        set category 8
                end
            end
        end
    end
end

```

```

    end
end

```

Configuring firewall settings for the Sales VDOM

Like the Accounting firewall settings, this configuration includes two firewall addresses and two firewall policies for the sales VDOM: one for the internal network, and one for the VDOM link with the management VDOM.

When entering the CLI commands, the number of the firewall policies must be high enough to be a new policy. Depending on the number of firewall policies on your FortiGate unit, this may require starting at a higher number than the 6 required for the default configuration. This number is added automatically when you configure firewall policies using the web manager interface.

The FortiClient application must be used on Sales network computers to ensure additional protection for the sensitive information and for protection against spam.

To configure firewall addresses - web-based manager:

1. Open the **Sales** VDOM.
2. Go to **Firewall Objects > Address > Address**.
3. Select **Create New**, enter the following information, and select **OK**.

Address Name	SalesLocal
Type	Subnet / IP Range
Subnet / IP Range	172.100.0.0
Interface	port3

4. Go to **Firewall Objects > Addresses**.
5. Select **Create New**, enter the following information, and select **OK**.

Address Name	SalesManagement
Type	Subnet / IP Range
Subnet / IP Range	10.0.1.0
Interface	SalesVlnk

To configure the firewall addresses - CLI:

```

config vdom
  edit Sales
    config firewall address
      edit SalesLocal
        set type iprange
        set subnet 172.100.0.0
        set associated-interface port2
      next
      edit SalesManagement
        set type iprange
        set subnet 10.0.1.0
        set associated-interface SalesVlnk
      next
    end
  end
end

```

```

end
end

```

To configure the firewall policies from SalesLocal to the Internet - web-based manager:

1. Open the **Sales** VDOM.
2. Go to **Policy > Policy**.
3. Select **Create New**, enter the following information, and select **OK**.

Source Interface/Zone	port3
Source Address	SalesLocal
Destination Interface/Zone	SalesVlnk
Destination Address	SalesManagement
Schedule	always
Service	OfficeServices
Action	ACCEPT
Log Allowed Traffic	enabled
Enable Endpoint Control Check	disabled
Redirect Non-conforming Clients to Download Portal	enabled

4. Open the **root** VDOM.
5. Go to **Policy > Policy**.
6. Select **Create New**, enter the following information, and select **OK**.

Source Interface/Zone	SalesVlnk
Source Address	SalesManagement
Destination Interface/Zone	external
Destination Address	all
Schedule	always
Service	OfficeServices
Action	ACCEPT
Protection Profile	scan
Log Allowed Traffic	enabled
Enable Endpoint Control Check	disabled

To configure the firewall policies from SalesLocal to the Internet - CLI:

```

config vdom
  edit root
    config firewall policy
      edit 6
        set srcintf port2
        set srcaddr SalesLocal
        set dstintf SalesVlnk
        set dstaddr SalesManagement
        set schedule always
        set service OfficeServices
        set action accept
        set profile-status enable
        set profile scan
        set logtraffic enable
        set endpoint-check enable
        set endpoint-redir-portal enable
      end
    end
  config vdom
    edit Sales
      config firewall policy
        edit 7
          set srcintf SalesVlnk
          set srcaddr SalesManagement
          set dstintf external
          set dstaddr all
          set schedule always
          set service OfficeServices
          set action accept
          set profile-status enable
          set profile scan
          set logtraffic enable
          set endpoint-check enable
        end
      end
    end
  end
end

```

To configure the firewall policies from the Internet to SalesLocal - web-based manager:

1. Open the **root** VDOM.
2. Go to **Policy > Policy**.
3. Select **Create New**, enter the following information, and select **OK**.

Source Interface/Zone	external
Source Address	all
Destination Interface/Zone	SalesVlnk
Destination Address	SalesManagement
Schedule	always

Service	OfficeServices
Action	ACCEPT
Protection Profile	scan
Log Allowed Traffic	enabled
Enable Endpoint Control Check	disabled

4. Open the **Sales** VDOM.
5. Go to **Policy > Policy**.
6. Select **Create New**, enter the following information, and select **OK**.

Source Interface/Zone	SalesVlnk
Source Address	SalesManagement
Destination Interface/Zone	port2
Destination Address	SalesLocal
Schedule	always
Service	OfficeServices
Action	ACCEPT
Protection Profile	scan
Log Allowed Traffic	enabled
Enable Endpoint Control Check	disabled
Redirect Non-conforming Clients to Download Portal	enabled

To configure the firewall policies from the Internet to SalesLocal - CLI:

```
config vdom
  edit root
    config firewall policy
      edit 8
        set srcintf external
        set srcaddr all
        set dstintf SalesVlnk
        set dstaddr SalesManagement
        set schedule always
        set service OfficeServices
        set action accept
        set profile-status enable
        set profile scan
        set logtraffic enable
```

```

        set endpoint-check enable
        set endpoint-redir-portal enable
    end
end
config vdom
edit Sales
    config firewall policy
    edit 9
        set srcintf SalesVlnk
        set srcaddr SalesManagement
        set dstintf port2
        set dstaddr SalesLocal
        set schedule always
        set service OfficeServices
        set action accept
        set profile-status enable
        set profile scan
        set logtraffic enable
        set endpoint-check enable
        set endpoint-redir-portal enable
    end
end
end

```

Configuring firewall settings between the Accounting and Sales VDOMs

Firewall policies are required for any communication between each internal network and the Internet. Policies are also required for the two internal networks to communicate with each other through the management VDOM.

The more limited AccountingSalesServices group of services will be used between Sales and Accounting to ensure the traffic is necessary business traffic only. These policies will result in a partially meshed VDOM configuration. The FortiClient application must be used to ensure additional protection for the sensitive accounting information.

Two firewall policies are required to allow traffic in both directions between Sales and Accounting.

To configure the firewall policy between Sales and Accounting on the management VDOM - web-based manager:

1. Open the **root** VDOM.
2. Go to **Policy > Policy**.
3. Select **Create New**, enter the following information, and select **OK**.

Source Interface/Zone	SalesVlnk
Source Address	SalesManagement
Destination Interface/Zone	AccountVlnk
Destination Address	AccountingManagement
Schedule	always
Service	AccountingSalesServices

Action	ACCEPT
Protection Profile	scan
Log Allowed Traffic	enabled
Enable Endpoint Control Check	disabled
Redirect Non-conforming Clients to Download Portal	enabled

4. Go to **Policy > Policy**.
5. Select **Create New**, enter the following information, and select **OK**.

Source Interface/Zone	AccountVlnk
Source Address	AccountingManagement
Destination Interface/Zone	SalesVlnk
Destination Address	SalesManagement
Schedule	always
Service	AccountingSalesServices
Action	ACCEPT
Protection Profile	scan
Log Allowed Traffic	enabled
Enable Endpoint Control Check	disabled
Redirect Non-conforming Clients to Download Portal	enabled

To configure the firewall policy between Sales and Accounting on the management VDOM - CLI:

```
config vdom
  edit root
    config system firewall policy
      edit 9
        set srcintf SalesVlnk
        set srcaddr SalesManagement
        set dstintf AccountVlnk
        set dstaddr AccountManagement
        set schedule always
        set service AccountingSalesServices
        set action accept
        set profile-status enable
        set profile scan
        set logtraffic enable
        set endpoint-check enable
```

```
        set endpoint-redir-portal enable
    next
    edit 10
        set srcintf AccountVlnk
        set srcaddr AccountManagement
        set dstintf SalesVlnk
        set dstaddr SalesManagement
        set schedule always
        set service AccountingSalesServices
        set action accept
        set profile-status enable
        set profile scan
        set logtraffic enable
        set endpoint-check enable
        set endpoint-redir-portal enable
    end
end
```

Testing the configuration

Once the inter-VDOM routing has been configured, tests must be conducted to confirm proper operation. If there are any problems, use the troubleshooting tips to resolve them.

This section includes the following topics:

- [Testing connectivity](#)
- [Troubleshooting Tips](#)

Testing connectivity

Testing connectivity ensures that physical networking connections as well as FortiGate unit interface configurations, including firewall policies, are properly configured.

The easiest way to test connectivity is to use the `ping` and `tracert` commands to confirm the connectivity of different routes on the network. Include testing:

- from AccountingLocal to Internet
- from Internet to AccountingLocal
- from SalesLocal to Internet
- from Internet to SalesLocal
- from AccountingLocal to SalesLocal.

When using the commands on a Windows computer, go to a command line prompt and enter either `ping <IP address>` or `tracert <IP address>`.

When using the commands on a FortiGate unit, go to the CLI and enter either `exec ping <IP address>` or `exec traceroute <IP address>`.

Troubleshooting Tips

When there are problems with connectivity, the following troubleshooting tips will help resolve the issues.

- If a multiple hop test, such as `tracert`, is not successful then reduce it to a single hop to simplify the test. Test each link of the path to see which hop is down. If all hops are up, check the FortiGate unit policies to ensure they allow basic traffic to flow as expected.

- If ping does not work, confirm that the FortiGate unit interfaces have Ping enabled and also ensure Ping is enabled in the firewall policies. Otherwise the Ping traffic will be blocked.
- If one protocol does not work but others do work, check the FortiGate unit firewall policies for that one protocol to ensure it is allowed.
- If there are unexplained connectivity problems, check the local computer to ensure it does not have a software firewall running that may be blocking traffic. MS Windows computers have a firewall running by default that can cause problems.

For additional troubleshooting, see [Troubleshooting Virtual Domains](#).

Troubleshooting Virtual Domains

When you are configuring VDOMs you may run into some issues, with your VDOM configuration, your network configuration, or your device setup. This section addresses common problems and specific concerns that an administrator of a VDOM network may have.

This section includes:

- [VDOM admin having problems gaining access](#)
- [FortiGate unit running very slowly](#)
- [General VDOM tips and troubleshooting](#)

VDOM admin having problems gaining access

With VDOMs configured, administrators have an extra layer of permissions and may have problems accessing their information.

Confirm the admin's VDOM

Each administrator account, other than the super_admin account, is tied to one specific VDOM. That administrator is not able to access any other VDOM. It may be possible they are trying to access the wrong VDOM.

Confirm the VDOM's interfaces

An administrator can only access their VDOM through interfaces that are assigned to that VDOM. If interfaces on that VDOM are disabled or unavailable there will be no method of accessing that VDOM by its local administrator. The super_admin will be required to either bring up the interfaces, fix the interfaces, or move another interface to that VDOM to restore access.

Confirm the VDOMs admin access

As with all FortiGate units, administration access on the VDOM's interfaces must be enabled for that VDOM's administrators to gain access. For example if SSH is not enabled, that is not available to administrators.

To enable admin access, the super_admin will go to the **Global > Network > Interfaces** page, and for the interface in question enable the admin access.

FortiGate unit running very slowly

You may experience a number of problems resulting from your FortiGate unit being overloaded. These problems may appear as:

- CPU and memory threshold limits exceeded on a continual basis
- AV failopen happening on a regular basis

- dropped traffic or sessions due to lack of resources

These problems are caused by a lack of system resources. There are a number of possible reasons for this.

Too many VDOMs

If you have configured many VDOMs on your system, past the default ten VDOMs, this could easily be your problem.

Each VDOM you create on your FortiGate unit requires system resources to function - CPU cycles, memory, and disk space. When there are too many VDOMs configured there are not enough resources for operation. This may be a lack of memory in the session table, or no CPU cycles for processing incoming IPS traffic, or even a full disk drive.

Go to **System > VDOM** and see the number of configured VDOMs on your system. If you are running 500 or more VDOMs, you must have a FortiGate 5000 chassis. Otherwise you need to reduce the number of VDOMs on your system to fix the problem. Even if you have the proper hardware, you may encounter noticeably slow throughput if you are using advanced features such as security profiles or deep content inspection with many configured VDOMs.

One or more VDOMs are consuming all the resources

If you have sufficient hardware to support the number of VDOMs you are running, check the global resources on your FortiGate unit. At a glance it will tell you if you are running out of a particular resource such as sessions, or users. If this is the case, you can then check your VDOMs to see if one particular VDOM is using more than its share of resources. If that is the case you can change the resource settings to allow that VDOM (or those VDOMs) fewer resources and in turn allow the other VDOMs access to those resources.

Too many Security Features in use

It is likely that reducing the Security Features in use regardless of number of VDOMs will greatly improve overall system performance and should be considered as an option.

Finally it is possible that your FortiGate unit configuration is incorrect in some other area, which is using up all your resources. For example, forgetting that you are running a network sniffer on an interface will create significant amounts of traffic that may prevent normal operation.

General VDOM tips and troubleshooting

Besides ping and traceroute, there are additional tools for troubleshooting your VDOM configurations. These include packet sniffing and debugging the packet flow.

Perform a sniffer trace

When troubleshooting networks, it helps to look inside the headers of packets to determine if they are traveling along the route you expect that they are. Packet sniffing can also be called a network tap, packet capture, or logic analyzing.



If your FortiGate unit has NP interfaces that are offloading traffic, this will change the sniffer trace. Before performing a trace on any NP interfaces, you should disable offloading on those interfaces.

What sniffing packets can tell you

If you are running a constant traffic application such as ping, packet sniffing can tell you if the traffic is reaching the destination, what the port of entry is on the FortiGate unit, if the ARP resolution is correct, and if the traffic is being sent back to the source as expected.

Sniffing packets can also tell you if the Fortigate unit is silently dropping packets for reasons such as RPF (Reverse Path Forwarding), also called Anti Spoofing, which prevents an IP packet from being forwarded if its Source IP does not either belong to a locally attached subnet (local interface), or be part of the routing between the FortiGate and another source (static route, RIP, OSPF, BGP). Note that RPF can be disabled by turning on asymmetric routing in the CLI (`config system setting, set asymmetric enable`), however this will disable stateful inspection on the FortiGate unit and cause many features to be turned off.



If you configure virtual IP addresses on your Fortigate unit, it will use those addresses in preference to the physical IP addresses. You will notice this when you are sniffing packets because all the traffic will be using the virtual IP addresses. This is due to the ARP update that is sent out when the VIP address is configured.

How to sniff packets

When you are using VDOMs, you must be in a VDOM to access the `diag sniffer` command. At the global level, the command is not available. This is limit the packets only to the ones on your VDOM, and protects the privacy of other VDOM clients.

The general form of the internal FortiOS packet sniffer command is:

```
diag sniffer packet <interface_name> <'filter'> <verbose> <count>
```

To stop the sniffer, type `CTRL+C`.

<interface_name>	The name of the interface to sniff, such as "port1" or "internal". This can also be "any" to sniff all interfaces.
<'filter'>	What to look for in the information the sniffer reads. "none" indicates no filtering, and all packets will be displayed as the other arguments indicate. The filter must be inside single quotes (').
<verbose>	The level of verbosity as one of: 1 - print header of packets 2 - print header and data from IP of packets 3 - print header and data from Ethernet of packets
<count>	The number of packets the sniffer reads before stopping. If you don't put a number here, the sniffer will run forever until you stop it with <CTRL C>.

For a simple sniffing example, enter the CLI command `diag sniffer packet port1 none 1 3`. This will display the next 3 packets on the port1 interface using no filtering, and using verbose level 1. At this verbosity level you can see the source IP and port, the destination IP and port, action (such as ack), and sequence numbers.

In the output below, port 443 indicates these are HTTPS packets, and 172.20.120.17 is both sending and receiving traffic.

```
Head_Office_620b # diag sniffer packet port1 none 1 3
interfaces=[port1]
filters=[none]
0.545306 172.20.120.17.52989 -> 172.20.120.141.443: psh 3177924955 ack 1854307757

0.545963 172.20.120.141.443 -> 172.20.120.17.52989: psh 1854307757 ack 3177925808

0.562409 172.20.120.17.52988 -> 172.20.120.141.443: psh 4225311614 ack 3314279933
```

For a more advanced example of packet sniffing, the following commands will report packets on any interface travelling between a computer with the host name of PC1 and the computer with the host name of PC2. With verbosity 4 and above, the sniffer trace will display the interface names where traffic enters or leaves the FortiGate unit. Remember to stop the sniffer, type CTRL+C. Note that PC1 and PC2 may be VDOMs.

```
FGT# diagnose sniffer packet any "host <PC1> or host <PC2>" 4
```

or

```
FGT# diagnose sniffer packet any "(host <PC1> or host <PC2>) and icmp" 4
```

The following sniffer CLI command includes the ARP protocol in the filter which may be useful to troubleshoot a failure in the ARP resolution (for instance PC2 may be down and not responding to the FortiGate ARP requests).

```
FGT# diagnose sniffer packet any "host <PC1> or host <PC2> or arp" 4
```

Debugging the packet flow

Traffic should come in and leave the VDOM. If you have determined that network traffic is not entering and leaving the VDOM as expected, debug the packet flow.

Debugging can only be performed using CLI commands. Debugging the packet flow requires a number of debug commands to be entered as each one configures part of the debug action, with the final command starting the debug.



If your FortiGate unit has NP interfaces that are offloading traffic, this will change the packet flow. Before performing the debug on any NP interfaces, you should disable offloading on those interfaces.

The following configuration assumes that PC1 is connected to the internal interface of the FortiGate unit and has an IP address of 10.11.101.200. PC1 is the host name of the computer.

To debug the packet flow in the CLI, enter the following commands:

```
FGT# diag debug enable
FGT# diag debug flow filter add <PC1>
FGT# diag debug flow show console enable
FGT# diag debug flow trace start 100
FGT# diag debug enable
```

The `start 100` argument in the above list of commands will limit the output to 100 packets from the flow. This is useful for looking at the flow without flooding your log or your display with too much information.

To stop all other debug activities, enter the command:

```
FGT# diag debug flow trace stop
```

The following is an example of debug flow output for traffic that has no matching Firewall Policy, and is in turn blocked by the FortiGate unit. The denied message indicates the traffic was blocked. Note that even with VDOMs not enabled, `vd-root` is still shown.

```
id=20085 trace_id=319 func=resolve_ip_tuple_fast line=2825 msg="vd-root received a
packet(proto=6, 192.168.129.136:2854->192.168.96.153:1863) from port3."

id=20085 trace_id=319 func=resolve_ip_tuple line=2924 msg="allocate a new session-
013004ac"

id=20085 trace_id=319 func=vf_ip4_route_input line=1597 msg="find a route: gw-
192.168.150.129 via port1"

id=20085 trace_id=319 func=fw_forward_handler line=248 msg=" Denied by forward policy
check"
```



High Performance Network Security



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